IMPACT OF INTENSIVE, HIGH-RISE DEVELOPMENT IN SAN FRANCISCO

AN EVALUATION OF ALTERNATE DEVELOPMENT GROWTH STRATEGIES

STEP 1 - PART B
A FINAL FEASIBILITY REPORT

SUMMARY

SPUR

SAN FRANCISCO PLANNING AND URBAN RENEWAL ASSOCIATION
126 Post Street, San Francisco, California 94108

STUDY OF INTENSIVE, HIGH-RISE DEVELOPMENT IN SAN FRANCISCO
STEP 1 - PART B
A FINAL FEASIBILITY REPORT
APRIL 1973

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STEP 1 - PART B SUMMARY

TABLE OF CONTENTS

INTRODUCTION

This volume is a summary of the four volumes that comprise the Step 1 - Part B Report of the study, "Impact of Intensive, High-Rise Development in San Francisco." This volume contains a summary of our findings to date in the topic areas of Generic Block Type Analysis, Municipal Finance, Urban Economics, and the Environment. Volumes 1-4 contain more detailed presentations of the data and methodologies that led to the findings discussed here.

An important aspect of our work in phase 1-B has been the development of tools and techniques which highlight the broader context in which the issue of high rise must be examined. This context is specified in the subtitle of the report "An evaluation of alternate development growth strategies".

This recognizes that the study will not only examine the impacts of high rise construction to determine as best as possible the consequences of various kinds of development, but also will look at low rise, mixtures of both, and, of course, minimal or no development or growth.

Thus as one reads the various summary sections of this volume, it should be understood that the term "high rise" is often a form of shorthand referring to different forms of development of many kinds.

At this point we have reached the end of Step 1, which is a test of the feasibility of conducting a comprehensive study into such a largely unexplored issue in urban policy. Accordingly, this volume and detailed volumes 2-5 focus on research methods and data sources.

Our aim has been to gain an appreciation of strengths and weaknesses of the methods and data available to us and evaluate the degree to which they will produce the kinds of objective, reliable estimates that are necessary for a study of this nature.

On the basis of the Step 1 - Part B study effort, summarized on the following pages, the study team believes that the study is feasible and will meet the objectives established for the study. Therefore, the study team recommends that the study proceed to Step 2, the establishment of development alternatives for San Francisco.

OVERVIEW

This work is a continuation of that previously presented in the Step 1 - Part A Report. Much work in this phase has been to test and refine work items proposed earlier. In most cases, tests have been successful. In some cases, new data sources had to be developed as existing and previously identified data sources proved to be unavailable or poorly structured for our purposes. In other cases, previously proposed methodological approaches were modified to keep the work within the twin constraints of objectivity and feasibility.

A major refinement and development in the study has been an increased focus on the "scenario" and the "generic block-type" as the basic tools for analysis.

Scenarios are plans for development that show how parts of the city might look in the future. Each one shows a future pattern of building form and uses traffic systems, parks, etc. Each scenario will be based on different assumptions about the nature of future growth of a specific district in San Francisco, and will enable us to describe the consequences of a variety of development policies to the people who live and work in the city. Hopefully, they will also prove valuable in future decision-making concerning major growth issues facing San Francisco and most other cities today.

A number of scenarios will examine various growth patterns in the downtown area focusing on Market Street. At this time the exact nature of the various scenarios is not known but it can be assumed that one will be based on a projection of the present growth patterns which assume a market demand for roughly 1.2 million square feet of commercial space per year concentrated in large buildings on both sides of the lower end of Market Street. Another might examine the effects of imposing a 120-foot height limit in the scenario area. Another might examine the impact of a zoning and development policy which would allow tall buildings only in the immediate proximity of rapid transit stations. Scenarios will also be developed for residential areas. These will cover a very much different area - approximately six to ten blocks.

It is realized that the precise design of each scenario is subjective and that actual development under the assumptions and rules that guide the individual scenarios may well be different in detail. However, it can be assumed that the general character of each scenario will be relatively accurate, and that the results will be both valuable and in keeping with the intent of the study - producing a generalized tool for projecting potential impacts of physical development alternatives.

At this time, it is well to note some of the limitations of the scenarios. One, perhaps the most important, is the fact that examination of their impact will be focussed primarily on the scenario area itself. Examination of their impact on the entire City of San Francisco and the surrounding region will be considerably less detailed. Obviously, the scenario areas, particularly the downtown scenario area, do not exist in a vacumm. The character of scenarios, particularly those which do not limit growth in any way, will be radically affected by the growth of the San Francisco Bay region as a whole, and also by the provision of public services, transportation systems, etc.

To clarify the notion of the scenario for Phase 1B, one has been constructed in broad forms. No specific results are projected based on the kinds of municipal finance, urban economics, or environmental effects which are generated by this scenario, although these projections will be a major product of the study. It is included at this time primarily to give the review group a sense of the scope, purpose and character of scenario development.

The scenario selected for this purpose is the one mentioned earlier reflecting the continuation of the existing free market conditions and trends in the downtown commercial-retail-hotel-industrial core. The time period under consideration is from 1973 to 1990. A graphic representation of block type changes under this scenario is shown in Map 6 in the graphics section following page 3.

The basic unit utilized in constructing various scenarios will be the generic block type. A generic block type is one which after study of a sample of over 300 blocks in San Francisco is found to be typical of certain patterns of development. Most of these are already in existence in San Francisco, but some will be developed to reflect additions which might evolve in the future. Each block type generates its own particular pattern of demands for the city's services, tax revenue, employment, transportation loads, and environmental effects.

In order to be able to specify these patterns, we have organized our empirical research under three broad topic headings: Municipal Finance, Urban Economics and Environment. Later sections of this summary discuss the methods and the data sources that we employ for research in each area.

In the Municipal Finance section our aim is to develop municipal cost/revenue ratios for each block type and to identify the municipal capital improvements - such as roads and water systems - that would be necessary for the realization of each of the scenarios.

I. BLOCK ANALYSIS

GENERIC BLOCK TYPES

Introduction

One common way of perceiving the city is in terms of block types - residential, commercial, high-rise, low-rise, and so on. The purpose of this block analysis study is to quantitatively define block types to enable their use as a planning and evaluation tool.

Derivations of Block Types

The initial testing of this method was derived from an analysis of blocks in an area of San Francisco bounded by Broadway, The Embarcadero, Bryant Street, 13th Street, South Van Ness and Van Ness Avenues.

This survey area was chosen because it includes most of the existing high-rise construction in San Francisco as well as a wide spectrum of low- and medium-rise blocks of all use categories. The survey area will be selectively expanded to include needed block types not represented in this area, such as the high-rise residential blocks on Russian Hill, or the Pacific Heights residential area.

Using Sanborn maps for the year 1972 as the primary data source, each building in each block of the study area (about 350 in number) was coded according to its height and use. A summary description of each block was then made, based on the median building height of the block, the highest building and the two most predominant uses (Map 1). Blocks with similar height and use codes were aggregated to form an initial block typology.

It was at first estimated that 25 block types would constitute both an adequate description of the city and a comprehensive number with which to work. It was, however, impossible to reduce the number of block types to this number without making artificial combinations. The diversity of city blocks--even when considered in simple terms of two predominant uses, median building height and highest building--yielded far more than 25 types.

A typology of 65 types was developed which seemed to be relatively accurate in representing reality in these areas. Each type represents sets of blocks that are essentially identical in terms of:

1. Physical development - total building area, building heights, and block floor area ratio (total building floor area divided by total block area);

2. Uses - allocation of total floor area of the block to various uses;

3. Age of buildings - average age of all buildings on the block;

4. Impacts on the city - in terms of municipal finance, urban economics, and environment. Impacts depend on specific aggregations and relative locations of blocks and will be developed in later phases.

Table 1 defines this initial classification of block types. Map 3 shows the pattern of use distribution, and Map 4 the pattern of building heights represented by this typology. All represent the city as it existed in December 1972.

In the continuation of the study other existing blocks will be examined in San Francisco and new block types derived. It is also possible that some types will be developed which represent intensities of development which do not now exist in San Francisco.

Use and Height Categories

Use categories were chosen on the basis of what types will be needed for construction development alternatives.

Residential -- buildings counted as residential range from single family houses through apartment buildings to rooming houses.

Stores -- retail establishments -- including banks, auto repair garages, and gas stations -- which rely on public access. Directly associated storage and office space in department stores is included.

Offices -- places where business is transacted without need for public access.

Hotels -- transient residence; includes the associated retail establishments found in large hotels, but not unrelated rental space in the same buildings as small hotels.

Wholesale -- includes both display-type establishments -- such as furniture and textile outlets -- and non-display office and distribution establishments; neither type has general public access.

Industrial -- production or repair of things without public access; contractors' offices and shops were included in this category.

Warehouse -- storage of bulk goods.

Parking -- automobile parking only; truck parking is considered industrial.

Park -- includes both landscaped areas and urban plazas.

Freeway -- includes on- and off-ramps as well as elevated structures.

"Other" -- includes government services other than office (government offices are included in the office category), churches, clubs, transportation terminals, public assembly buildings, and hospitals.

Height categories were derived from the median height and highest building descriptions of the blocks in the survey area. Frequency of occurrence and suitability to development alternatives were considered in establishing the categories.

Block Analysis

A sample of approximately 20% of the blocks of each type (2 minimum) was selected for more detailed analysis. Omitted from the sample were freeway blocks, because of the uncertainty of how they should be measured, and whether existing types are representative of types that would be used in the future. Also omitted are non-rebuilt renewal blocks and special use blocks. A data sheet, called a Generic Block Description Form, is being prepared for each sample block.

Of the 95 blocks selected to be sampled, 54 have now been documented in this manner. A sample of these are shown in Exhibit 1, which also includes additional descriptive material in the form of drawings and photographs to illustrate the character of the blocks. The Generic Block Description Forms, extended as necessary to include blocks outside the initial survey area, and supplemented by descriptions of blocks that do not now exist in San Francisco, will be the source of a revised block typology which will be used in subsequent phases of this study.

(Page numbers for the following graphics refer to their place in the original report, Volume 1 - Block Analysis.)

Use Categories	Block Types	Height Categories	Number of Blocks–North of Market	South of Market	Sample Blocks
Residential	1.1.1	2	7	-	154, 157
	1.1.2	3	17	-	212, 183, 276, 248
	1.1.3	(2-3)+(10-19)	11	-	215, 243, 256
	1.1.4	4 - 7	3	-	274, 281
	1.1.5	(2-3)+(20-30)	1	-	
Residential + Store	1.2.1	2	3	-	
	1.2.2	3	9	-	181, 621
	1.2.3	4 - 7	11	-	301, 303, 336
	1.2.4	22 - 25	3	-	198, 199 (Golden Gateway)
	1.2.6	3 + (10-19)	3	-	
	1.2.7	4 + (10-19)	7	-	337, 716
Residential + Store + Hotel	1.3.1	4 + (10-19)	6	-	317, 323
	1.3.2	3 - 5	3	-	
Office + Residential + Store	2.1	29	1	-	813 (Fox Plaza)
Store	3.1	2 - 3	6	-	342, 350
Store + Residential (* = Chinatown)	3.2.1	2 - 3	16	-	739, 598, 667, 645, 694 193*, 226*
	3.2.2	4 - 7	1	-	
Store + Office	3.3.1	2 - 3	9	13	355, 227, 164, 3507, 3721
	3.3.2	4	3	-	
	3.3.3	5 - 7	4	-	314 (Macy's), 310
	3.3.4	(3-4)+(10-19)	3	2	309, 329, 3735
	3.3.5	(4-5)+(10-19)	1	1	294, 3705
Store + Office + Residential + Hotel	3.4.1	3 - 5	13	1	326, 306, 346, 340
	3.4.2	(4-5)+(10-19)	4	1	
	3.4.3	(4-5)+(20-30)	2	-	
	3.4.4	7	1	-	
Office	4.1.1	8 - 11	6	1	240, 238, 3713
	4.1.2	19 - 20	2	-	290, 764
	4.1.3	30+	1	-	264
Office + Store	4.2.1	3 - 4	6	-	196, 175
	4.2.2	6 - 10	5	1	261, 287
	4.2.3	(2-3)+(10-19)	4	1	236, 270
	4.2.4	(2-3)+(20-30)	6	-	228, 258, 204
	4.2.5	(2-3)+ 30+	4	1	291, 207 (Transamerica)
	4.2.6	(4-5)+(10-19)	3	2	288, 266
	4.2.7	(4-5)+(20-30)	3	3	289, 292, 3722, 267
	4.2.8	(4-5)+ 30+	1	1	311
	4.2.9	16 + 30+	1	-	259 (Bank of America)
	4.2.10	30+	1	-	230 (One Embarcadero Ctr.)

BLOCK TYPES

table 1 page 1

Use Categories	Block Types	Height Categories	Number of Blocks-North of Market	South of Market	Sample Blocks
Hotel	5.1.1	18	2	-	
	5.1.2	6 + 29	1	-	244 (Fairmont)
	5.1.3	17 + 44	1	-	325 (Hilton)
Hotel + Store	5.2.1	3 + 25	1	-	208 (Holiday Inn)
	5.2.2	9 + 35	1	-	
	5.2.3	12 + 30	1	-	307 (St. Francis)
Industry	6.1.1	1 - 3	-	3	3744, 3747
	6.1.2	5 - 6	-	1	
Industry + Store + Residential	6.2.1	2 - 3	2	27	3511, 3756. 3757, 3730, 3725, 3753
Warehouse + Wholesale + Industry	7.1.1	2 - 3	-	7	3520, 2768
	7.1.2	6	-	1/2	
Parking - On or Above Grade	8.1.1	0	1	1	
	8.1.2	1+	1	1/3	3724, 286
Parking - Below Grade + Park Above	8.2	0	2	-	308 (Union Square)
Park	9.1	0	3	1	172 (Sidney Walton Park)
Freeway -					
Elevated + Parking Under	10.1	-	-	1	
Elevated, No Parking	10.2	-	-	2	
Elevated, On-Off Ramps	10.3	-	1	3	
Elevated, Through Industrial Block	10.4	-	-	5	
Urban Renewal-Demolished Not Rebuilt	11.1	0	4	2	
Special:					
Government Services	12.1	Various	5	3	
Churches	12.2		1	-	
Clubs	12.3		1	-	
Transportation Terminals	12.4		-	1	
Public Assembly	12.5		2	-	
Hospital	12.7		1/2	-	

BLOCK TYPES

table 1 page 2

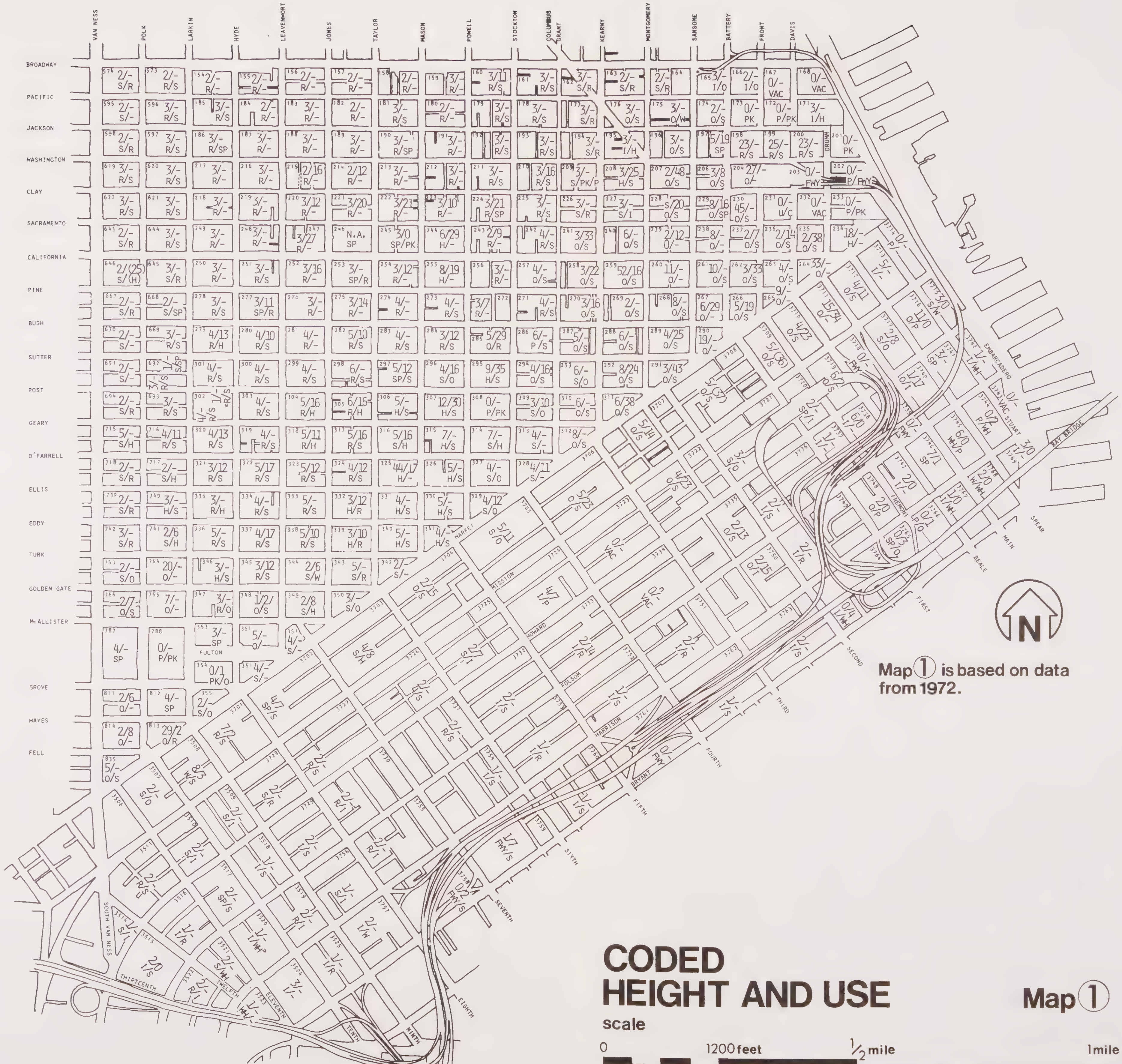
KEY

median height
highest building

N/N
Y/Z

secondary use
predominant use

R	residential
S	store (retail)
O	office
H	hotel
I	industry
W	wholesale
WH	warehouse
P	park
PK	parking
FWY	freeway
VAC	vacant
SP	special



Map ① is based on data from 1972.

CODED HEIGHT AND USE

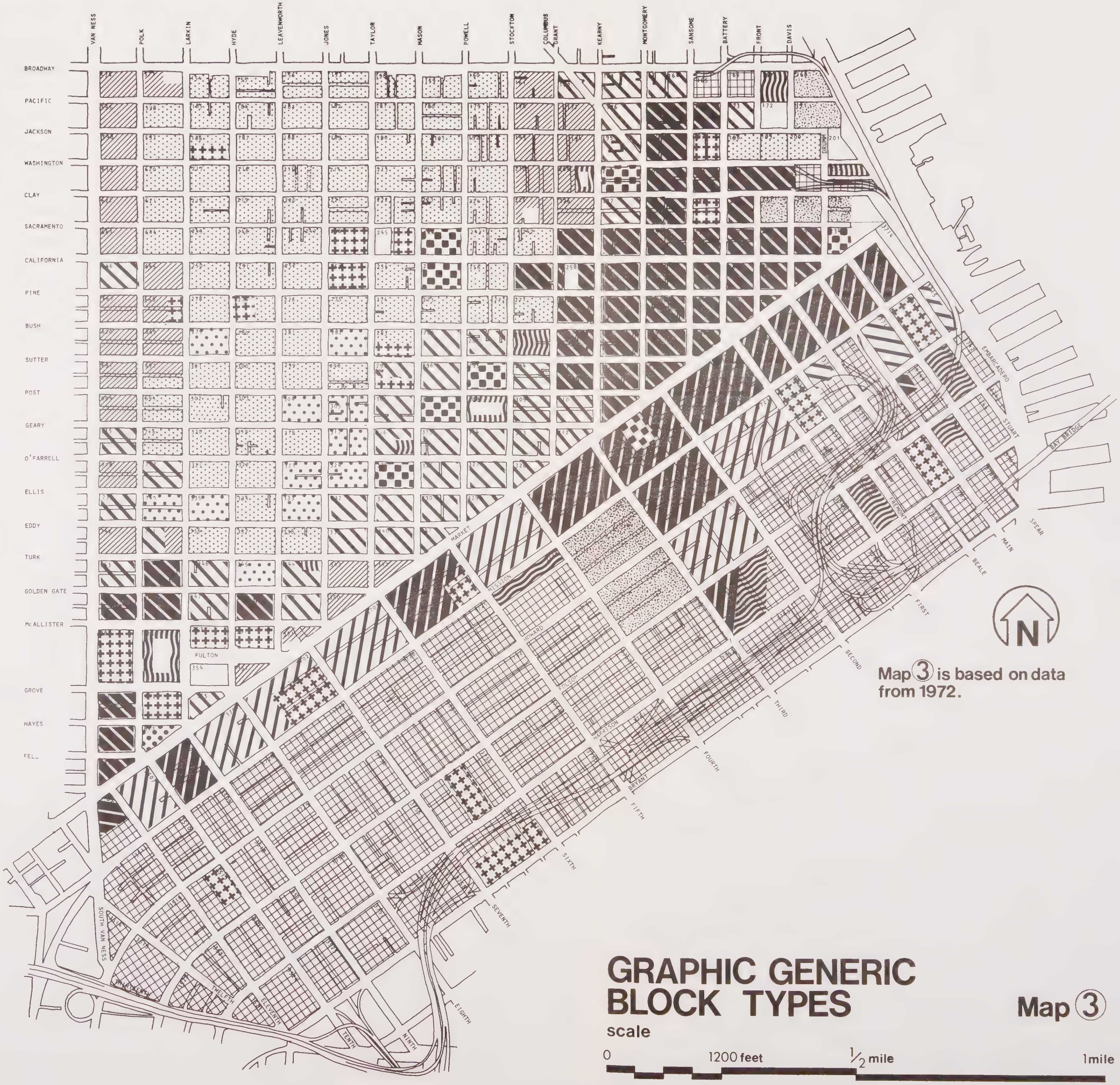
scale

0 — 1200 feet — ½ mile — 1 mile

Map ①

KEY

- 1.1 residential
- 1.2 residential + store
- 1.3 residential + store + hotel
- 2.1 office + residential + store
- 3.1 store
- 3.2 store + residential
- 3.3 store + office
- 3.4 store + office + residential + hotel
- 4.1 office
- 4.2 office + store
- 5.1 hotel
- 5.2 hotel + store
- 6.1 industry
- 6.2 industry + store + residential
- 7.1 warehouse + wholesale + industry
- 10.1-4 freeway
- 8.1 parking on grade or above
- 8.2 parking below grade with park above
- 9.1 open space
- 11.1 undeveloped urban renewal
- 12.1-7 special



Map 3 is based on data from 1972.

GRAPHIC GENERIC BLOCK TYPES

Map 3

scale

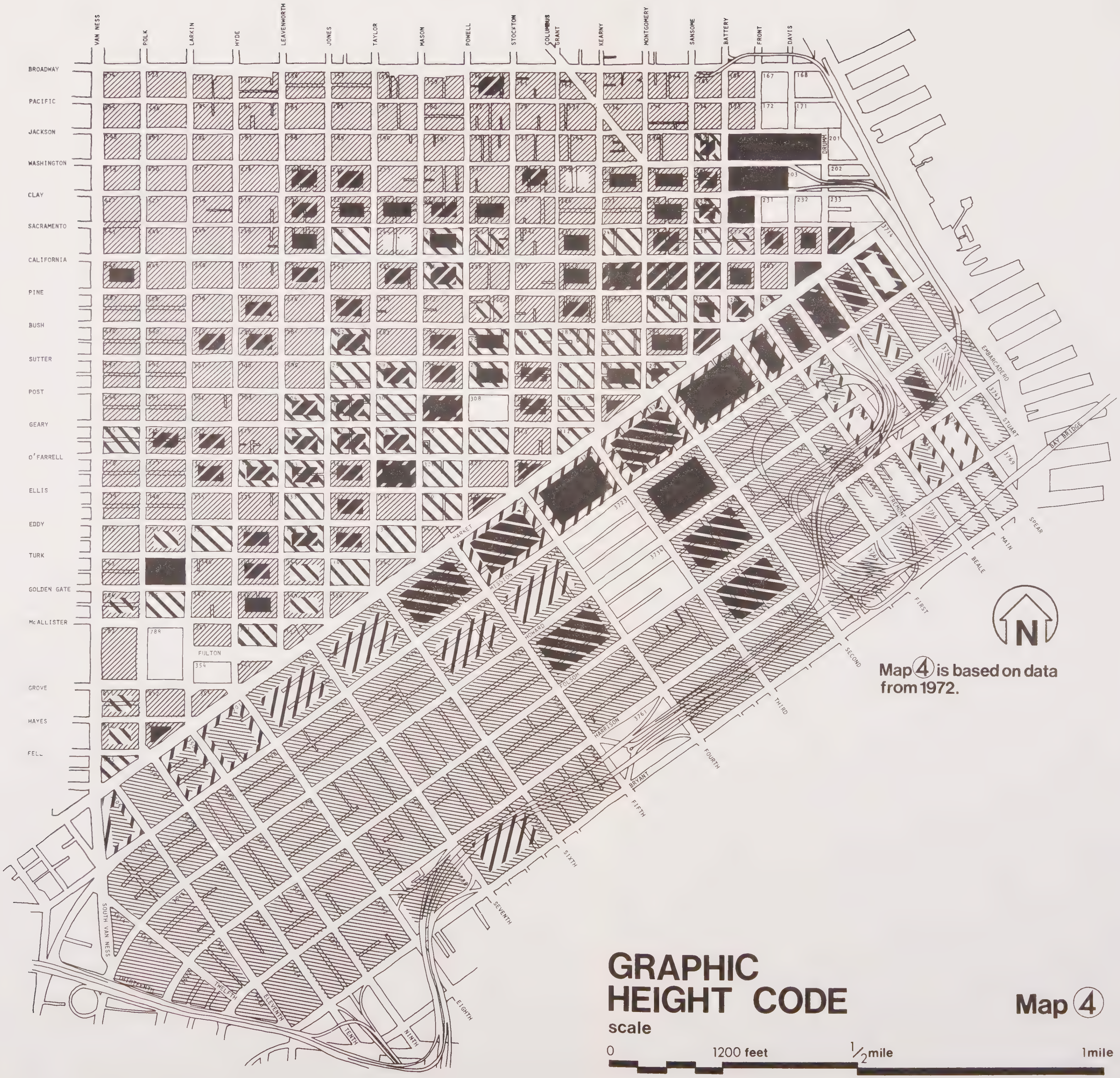
0 — 1200 feet — 1/2 mile — 1mile

KEY

- open space
- 1-4 stories
- 5-9 stories
- 10-19 stories
- 20+ stories

median height

highest building



Map ④ is based on data from 1972.

GRAPHIC HEIGHT CODE

Map ④

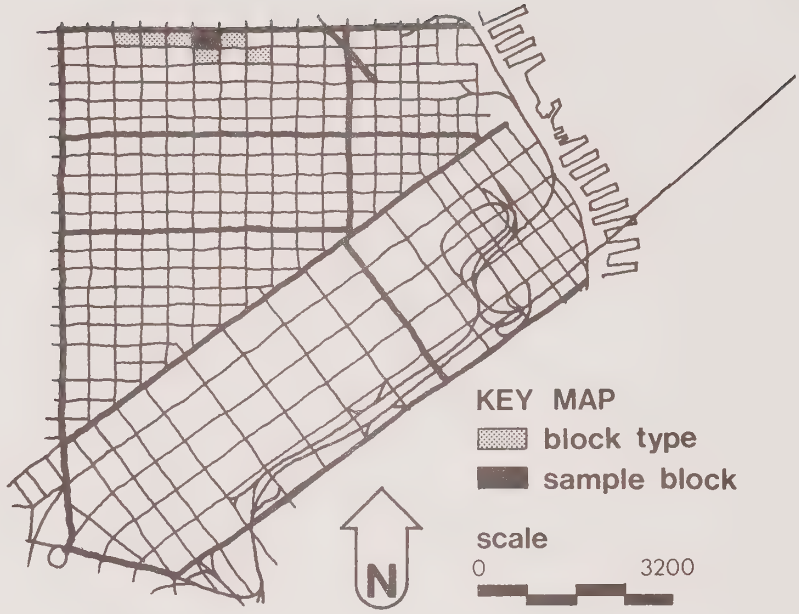
scale

0 — 1200 feet — 1/2 mile — 1 mile

Exhibit 1

BLOCK
ILLUSTRATIONS

1.1.1
RESIDENTIAL

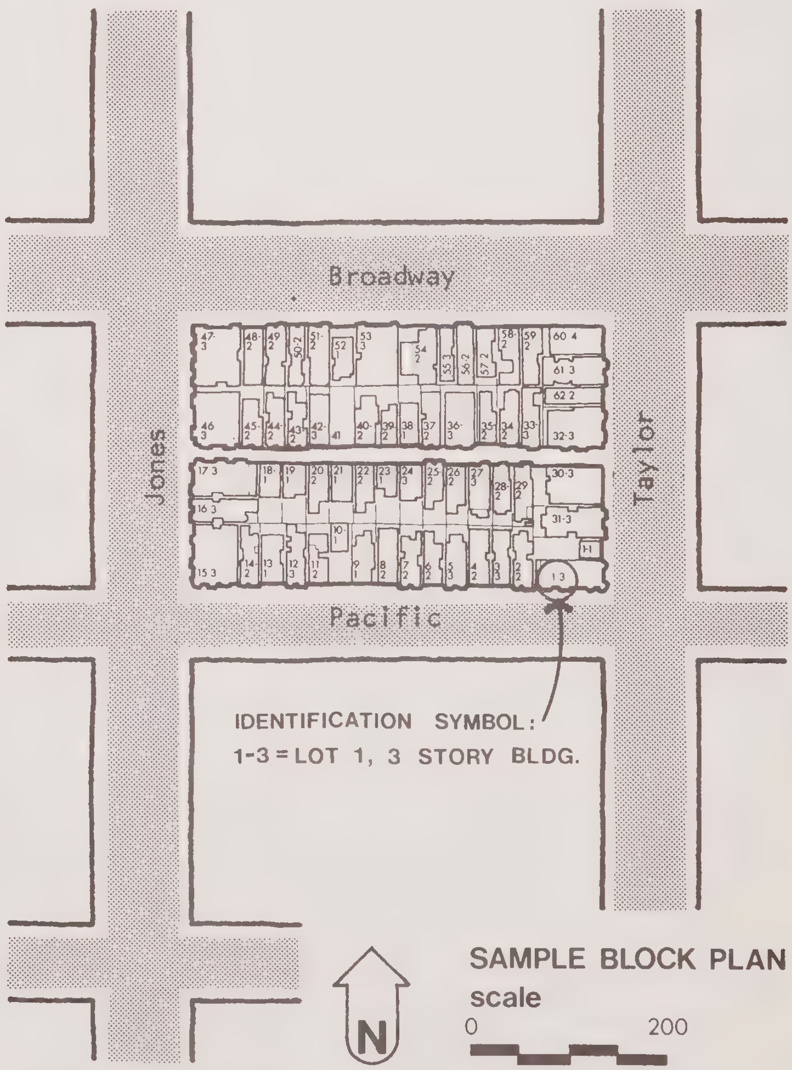


descriptive summation

use	-residential	
height	-2	
number of blocks	-north of Market	7
	south of Market	0
	total	7

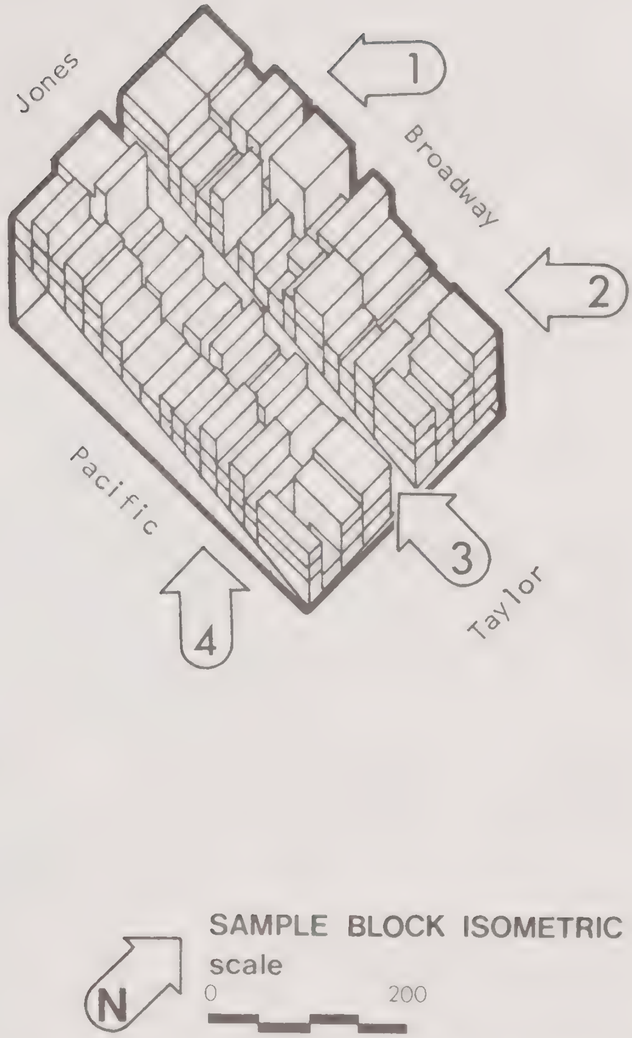
sample block description
block (157)

major uses	-residential
building area	-174,471sq.ft.
block area	-275x412.5 = 113,438sq.ft.
block coverage	-75%
block FAR	-1.54:1
median height	-2 floors
highest building	-4 floors
average age	-1917(1900-1955)
comments	



1 Broadway

2 Taylor-Broadway



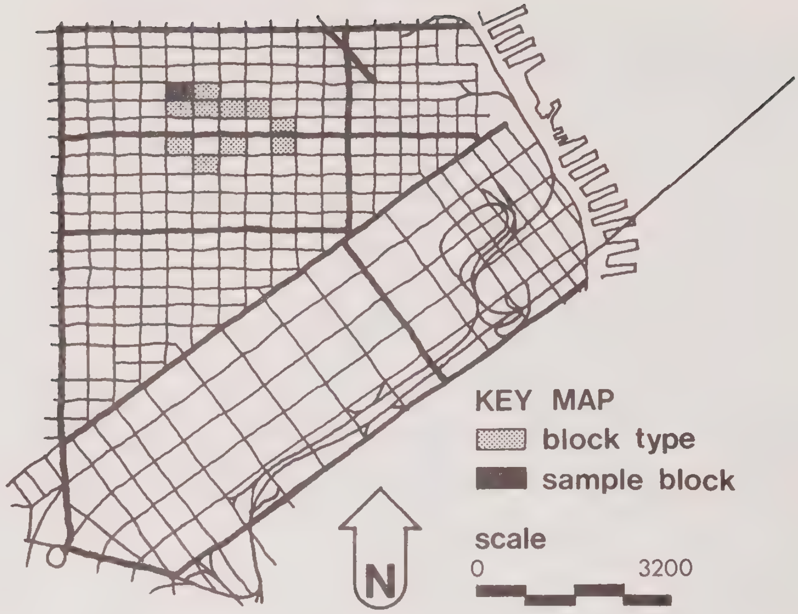
3 Taylor

4 Pacific

1.1.3
RESIDENTIAL

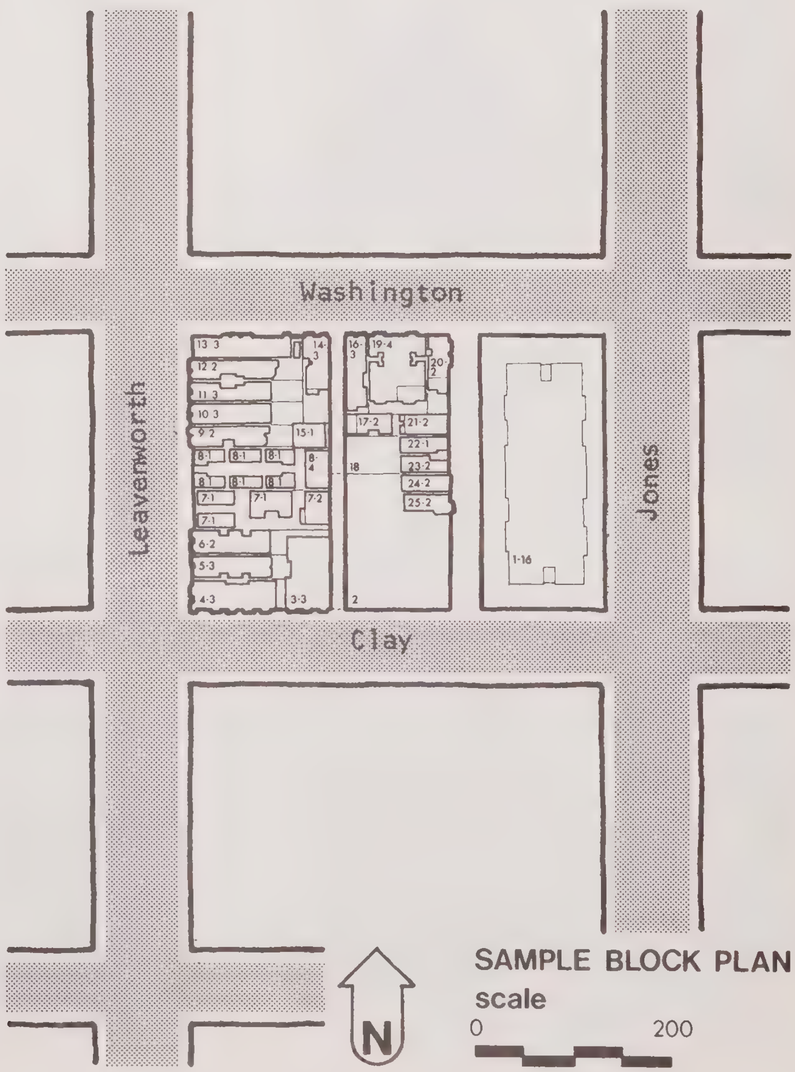
descriptive summation

use	-residential	
height	-(2-3)+(10-19)	
number of blocks	-north of Market	11
	south of Market	0
	total	11



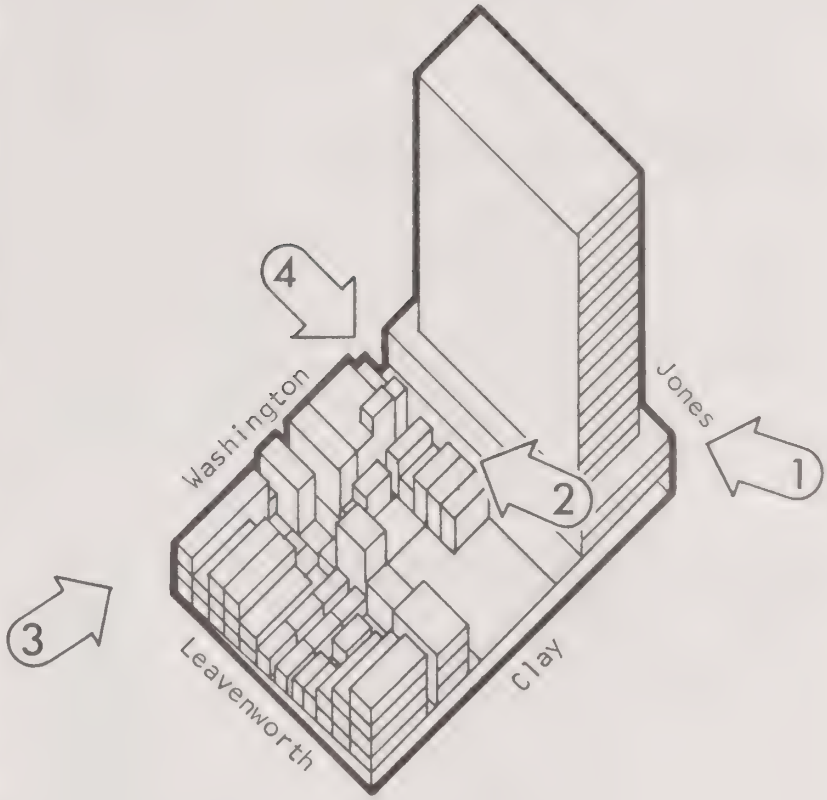
sample block description
block 215

major uses	-residential
building area	-392,476sq.ft.
block area	-275x412.5 = 113,348sq.ft.
block coverage	-62%
block FAR	-3.46:1
median height	-2 floors
highest building	-16 floors
average age	-1949(1906-1960)
comments	



1 Jones-Clay

2 Within Block

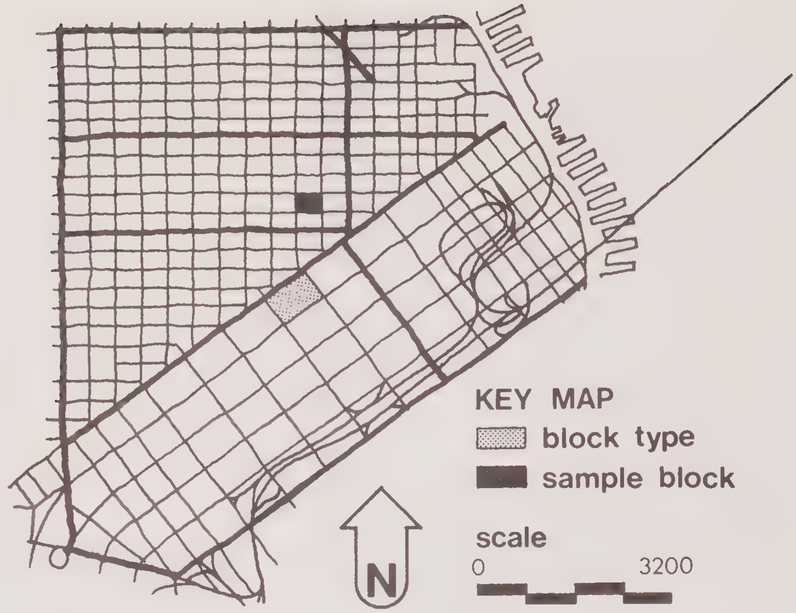


SAMPLE BLOCK ISOMETRIC
scale
0 200
N

3 Washington-Leavenworth

4 Washington

3.3.5
STORE·OFFICE

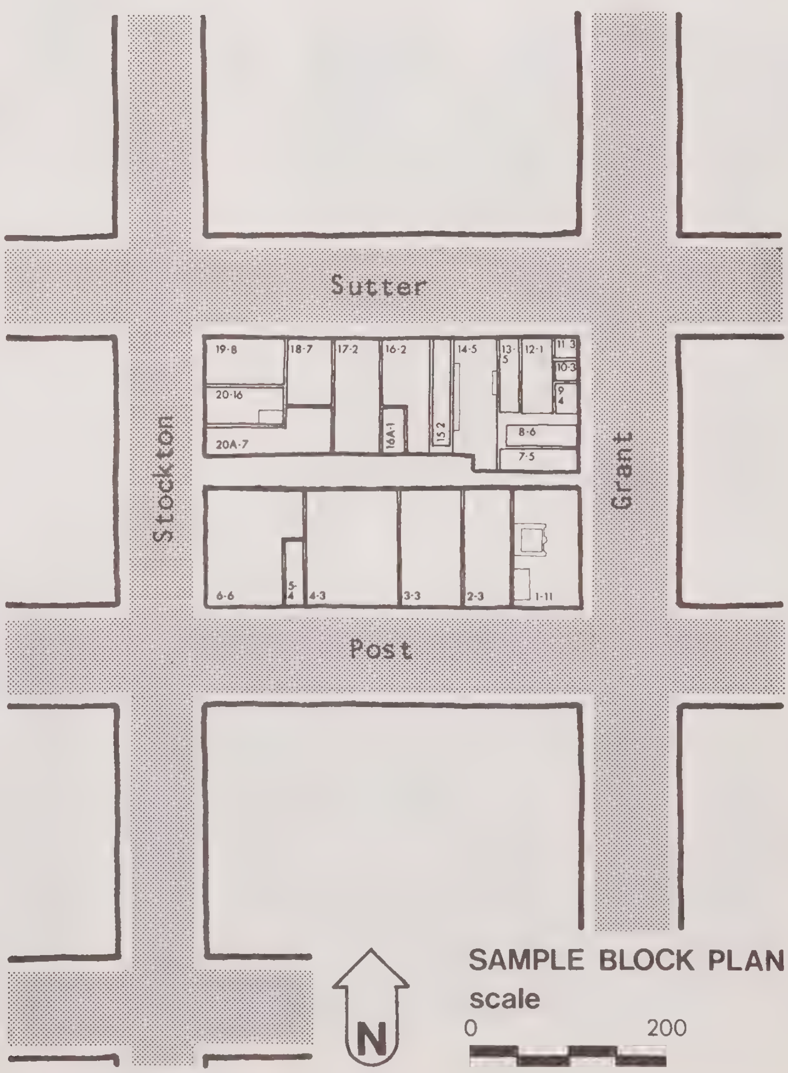


descriptive summation

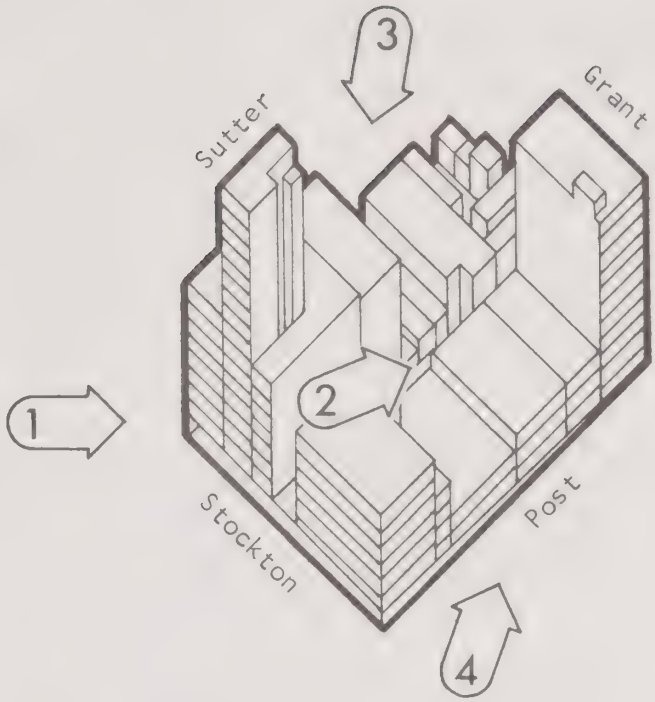
use	-store and office
height	-(4-5)+(10-19)
number of blocks	-north of Market 1 south of Market 1 total 2

sample block description
block 294

major uses	-office and store
building area	-450,776sq.ft.
block area	-382.6x275 = 102,215sq.ft.
block coverage	-88%
block FAR	-4.41:1
median height	-4 floors
highest building	-16 floors
average age	-1911(1905-1971)
comments	



1 Sutter-Stockton



2 Within Block

SAMPLE BLOCK ISOMETRIC

scale

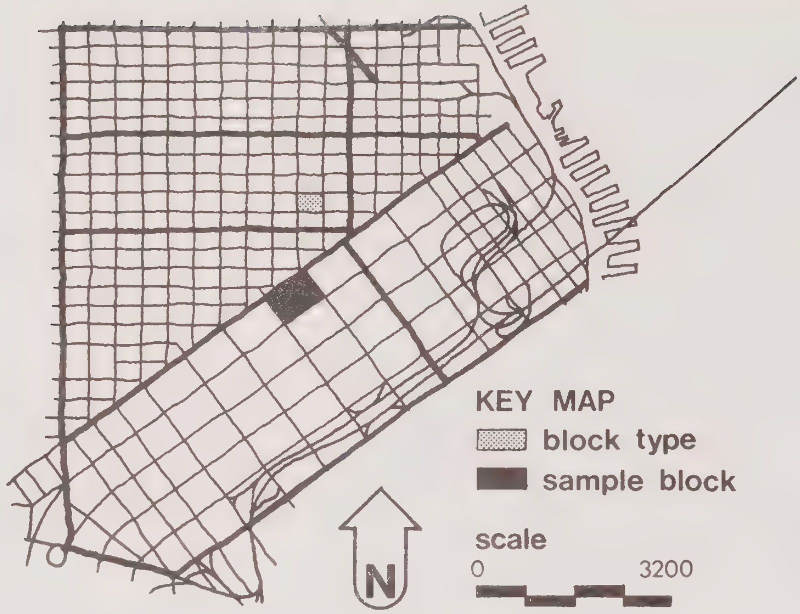
0 200

N

3 Sutter

4 Post

3.3.5
STORE+OFFICE

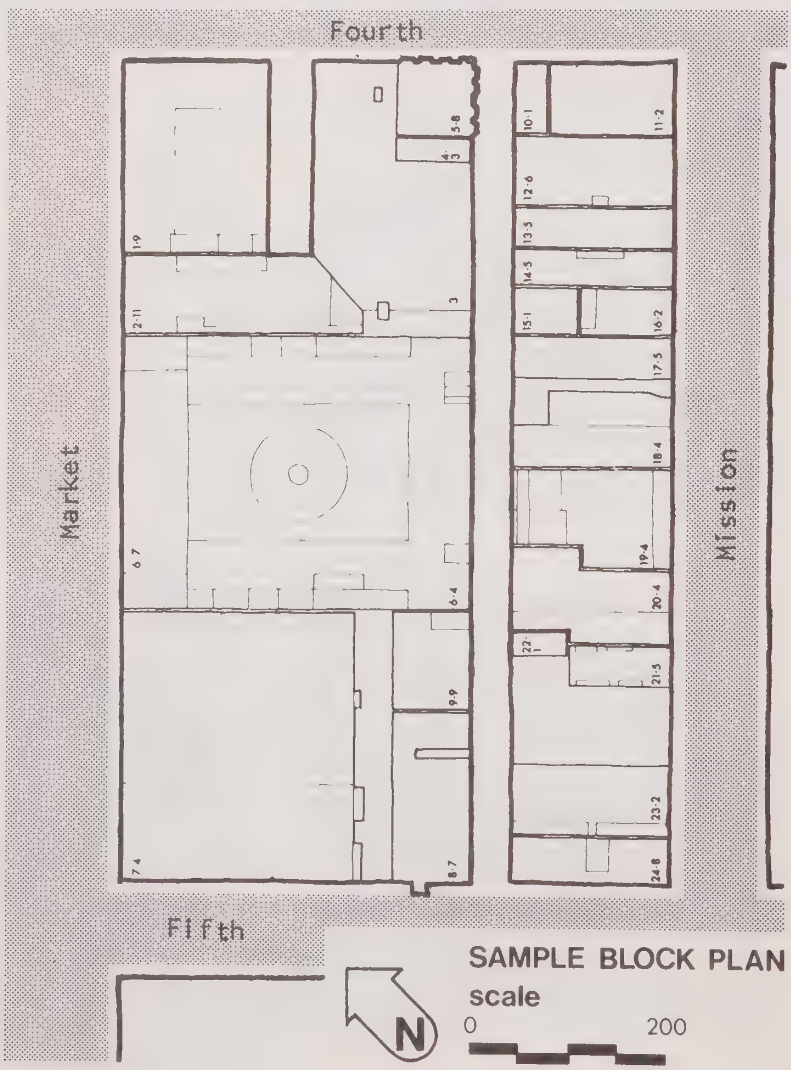


descriptive summation

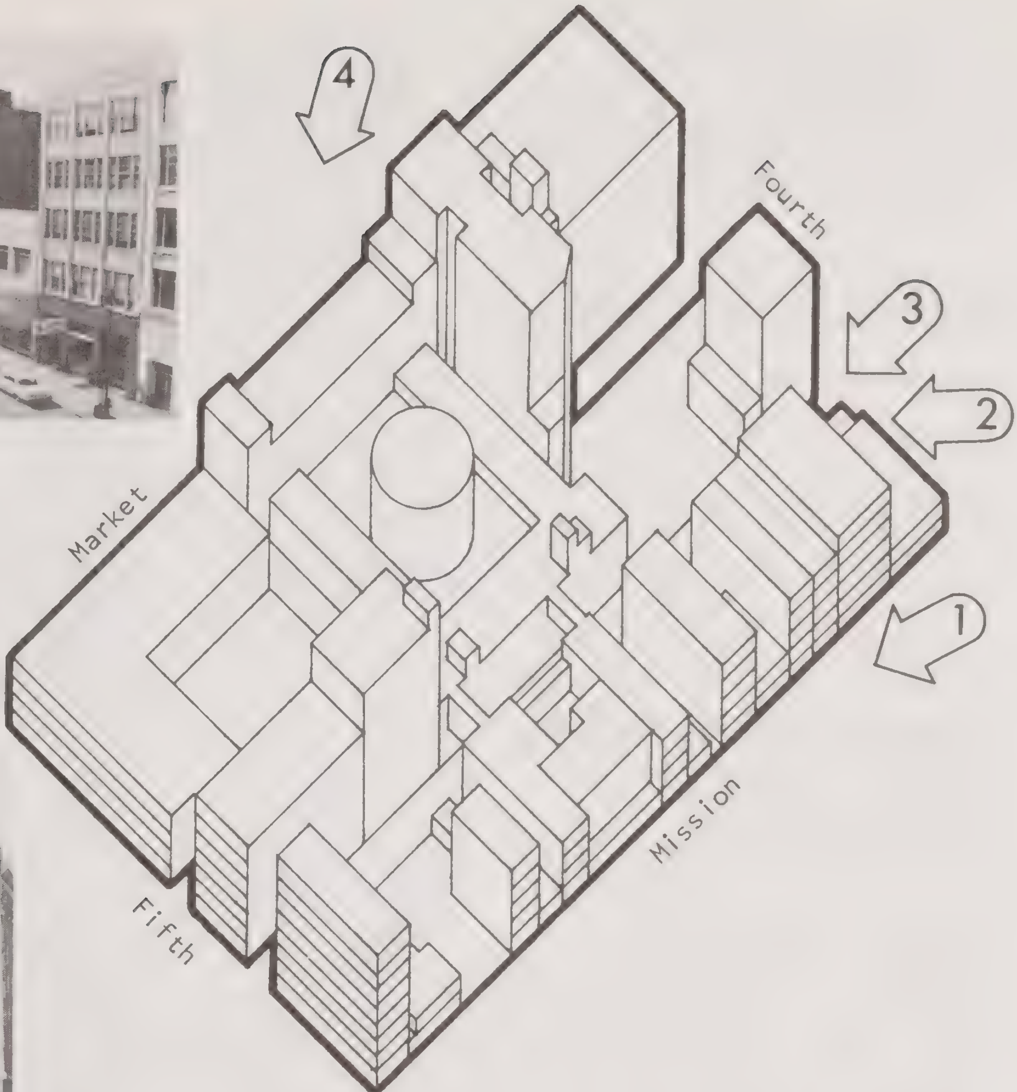
use	-store-office
height	-(4-5)+(10-19)
number of blocks	-north of Market 1 south of Market 1 total 2

sample block description
block 3705

major uses	-store and office
building area	-1,585,832sq.ft.
block area	-825x550 = 453,750sq.ft.
block coverage	-79%
block FAR	-3.49:1
median height	-5 floors
highest building	-11 floors
average age	-1913(1907-1950)
comments	



1 Mission



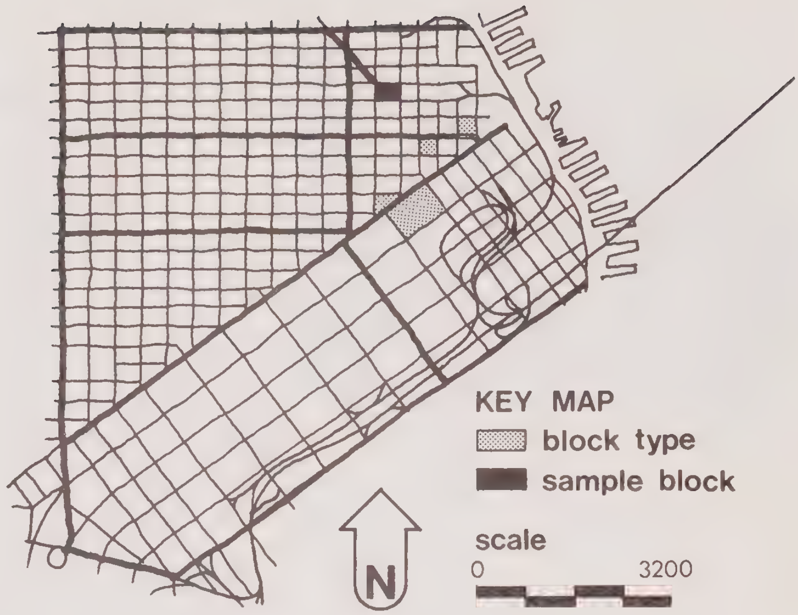
2 Fourth-Misson

SAMPLE BLOCK ISOMETRIC
scale
0 200
N

3 Fourth

4 Market

4.2.5
OFFICE + STORE

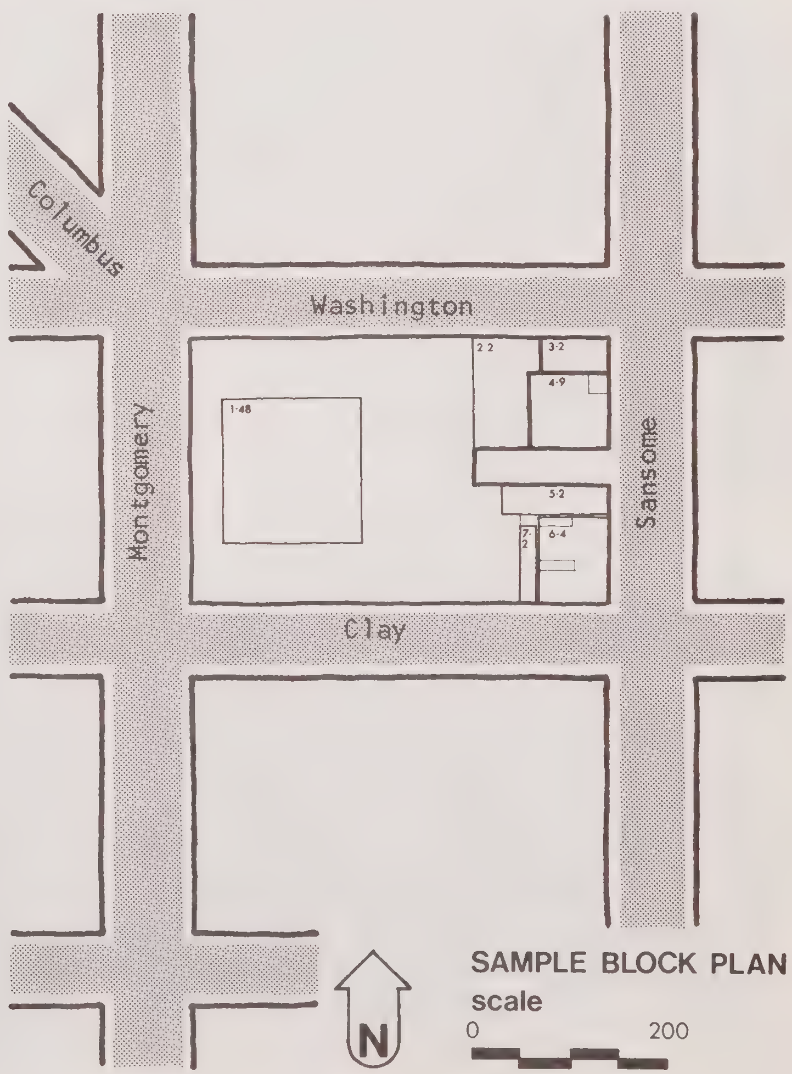


descriptive summation

use	-office and store
height	-(2-3)+30+
number of blocks	-north of Market 4
	south of Market 1
	total 5

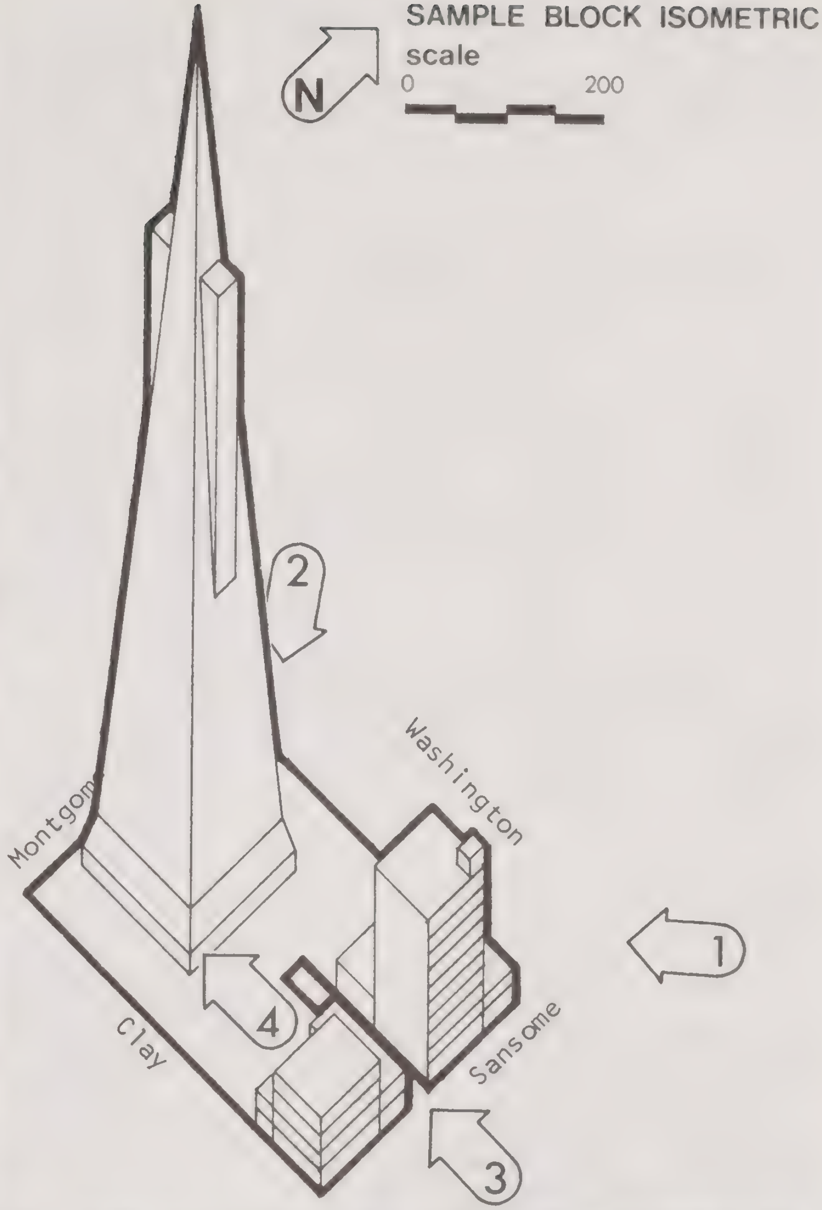
sample block description
block 207

major uses	-office
building area	-585,997sq.ft.
block area	-275x412.5 = 103,969sq.ft.
block coverage	-53%
block FAR	-5.64:1
median height	-2 floors
highest building	-48 floors
average age	-1964(1907-1972)
comments	



1 Sansome-Washington

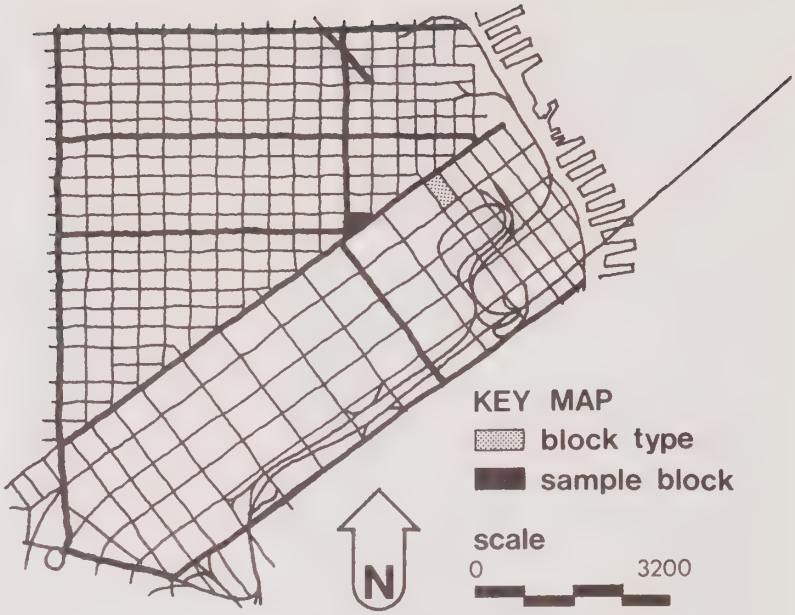
2 Washington-Montgomery



3 Sansome

4 Within Block

4.2.8
OFFICE + STORE

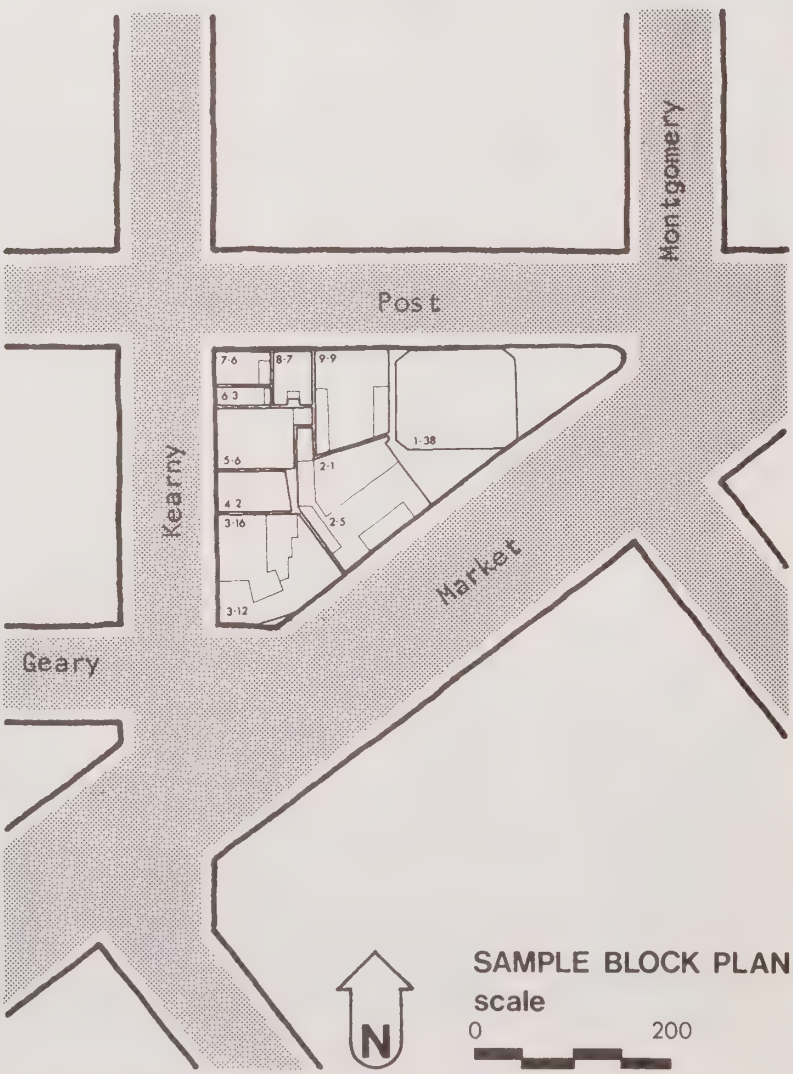


descriptive summation

use	-office and store
height	-(4-5)+30+
number of blocks	-north of Market 1 south of Market 1 total 2

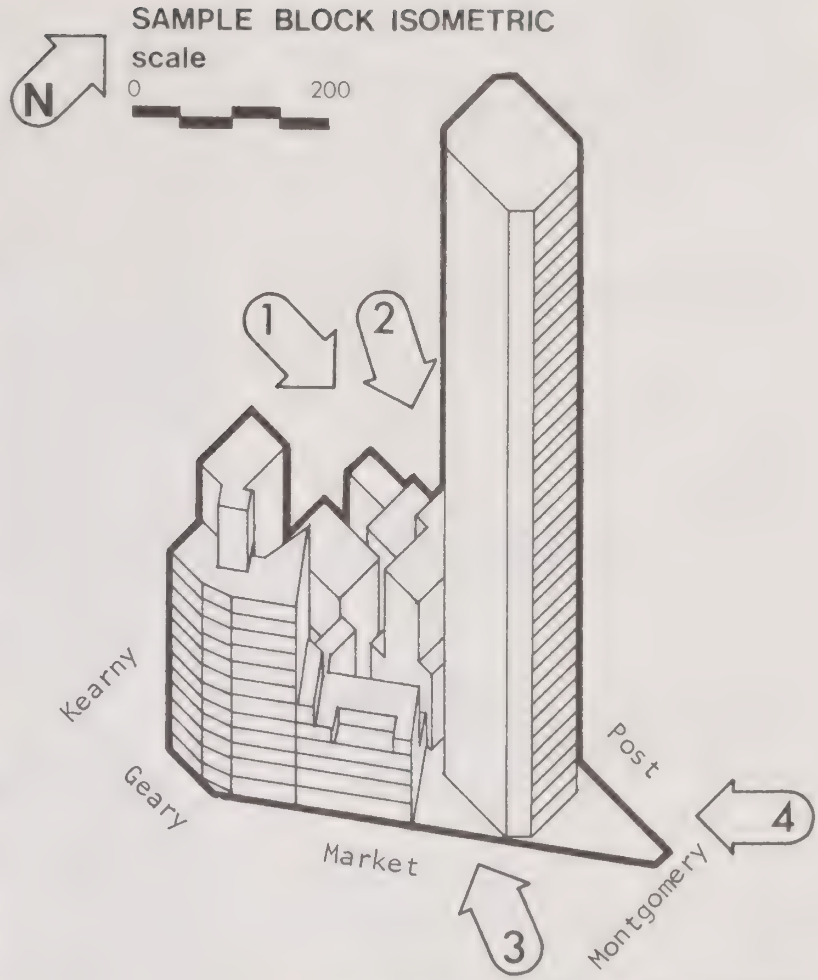
sample block description
block (311)

major uses	-office
building area	-774,480sq.ft.
block area	-275x414.88 = 68,243sq.ft.
block coverage	-84%
block FAR	-11.35:1
median height	-6 floors
highest building	-38 floors
average age	-1943(1907-1968)
comments	



1 Post

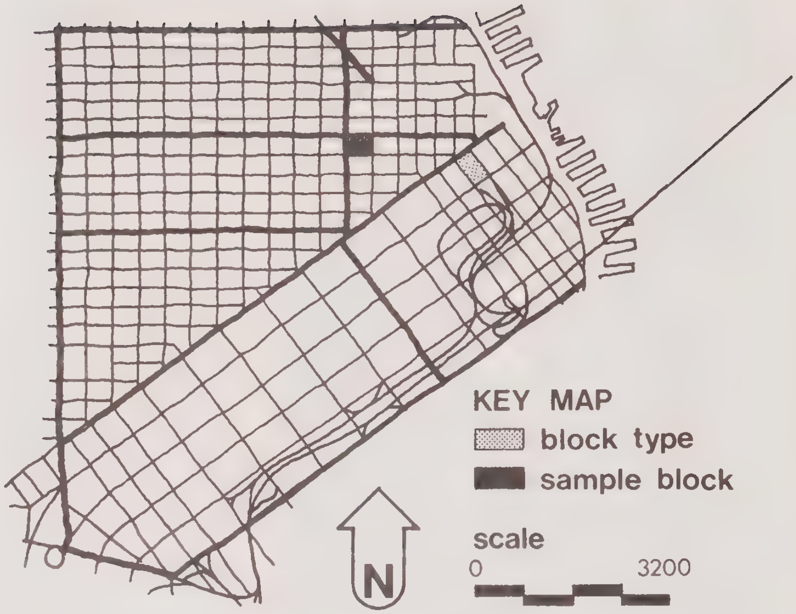
2 Post-Kearny



3 Market-Montgomery

4 Montgomery-Post

4.2.9
OFFICE+STORE

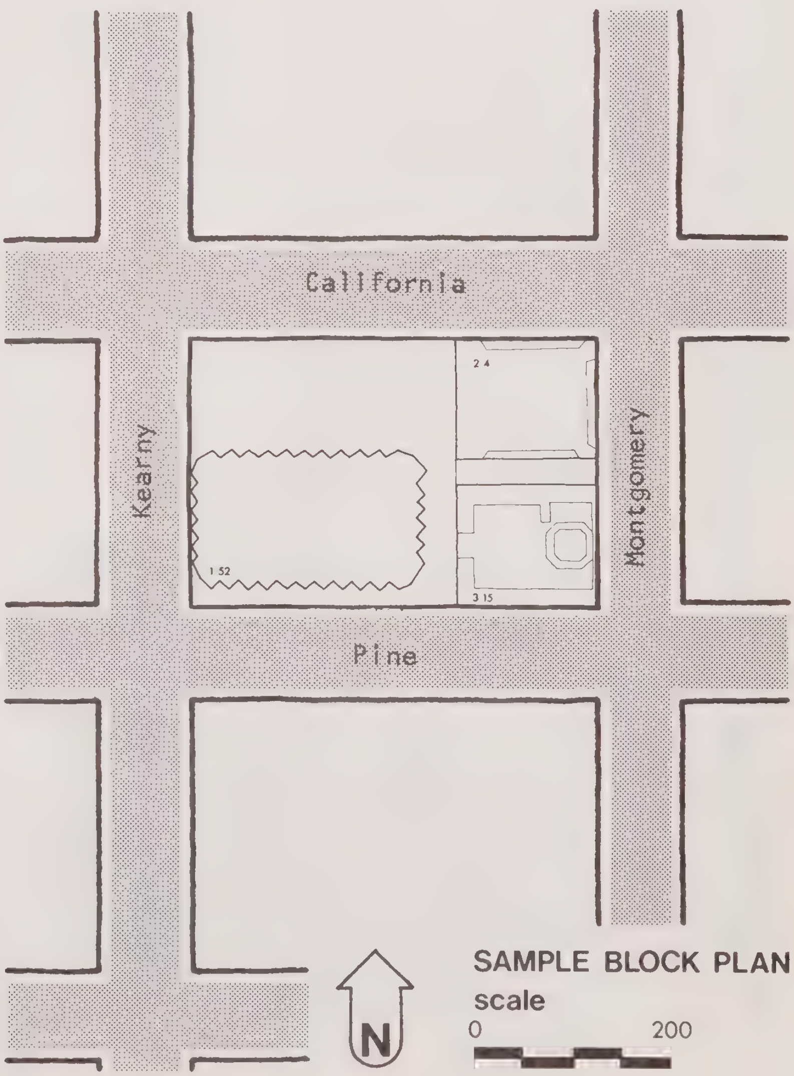


descriptive summation

use	-office and store
height	-16+30+
number of blocks	-north of Market 1 south of Market 1 total 2

sample block description
block 259

major uses	-office(Bank of America)
building area	-1,931,625sq.ft.
block area	-414.42x275.52 = 114,098sq.ft.
block coverage	-60%
block FAR	-16.92:1
median height	-not applicable
highest building	-52 floors
average age	-1961(1921-1971)
comments	

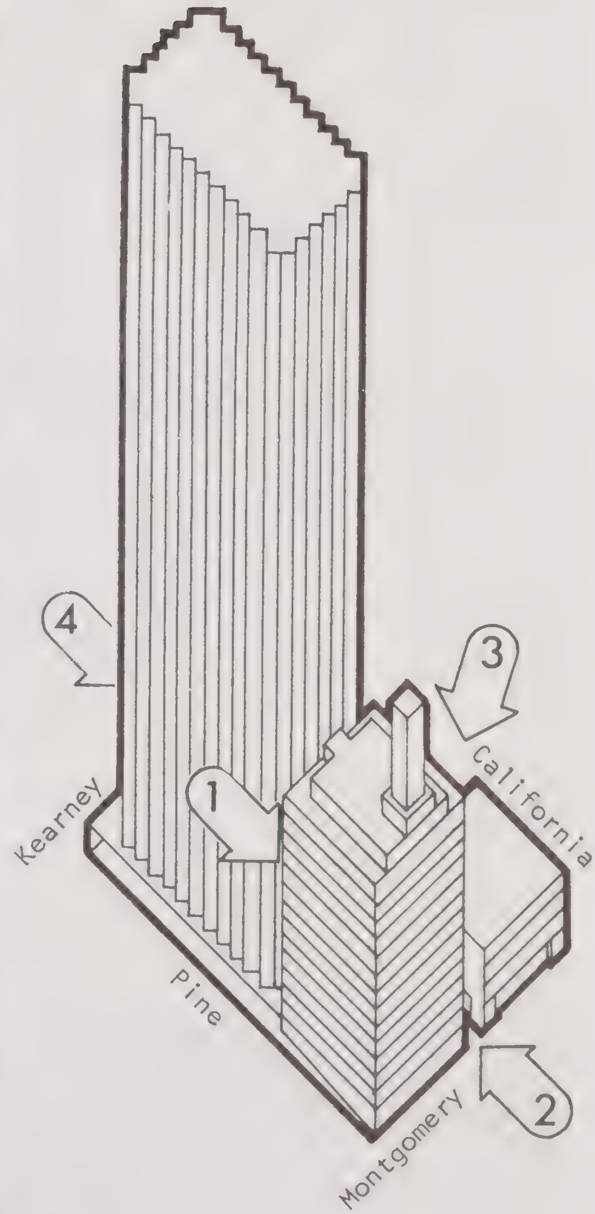


1 Within Block

2 Montgomery

3 California

4 Kearny-California

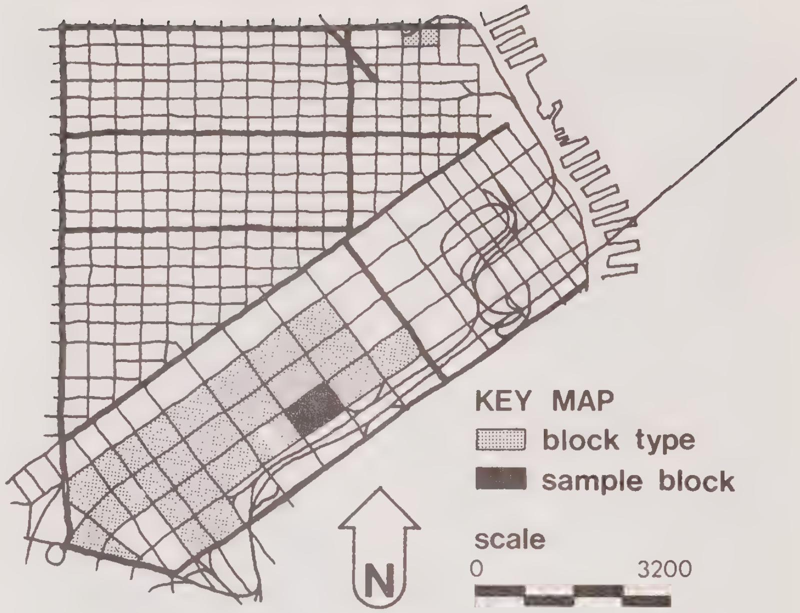


SAMPLE BLOCK ISOMETRIC

scale

0 200

6.2.1
INDUSTRY+STORE+ RESIDENTIAL

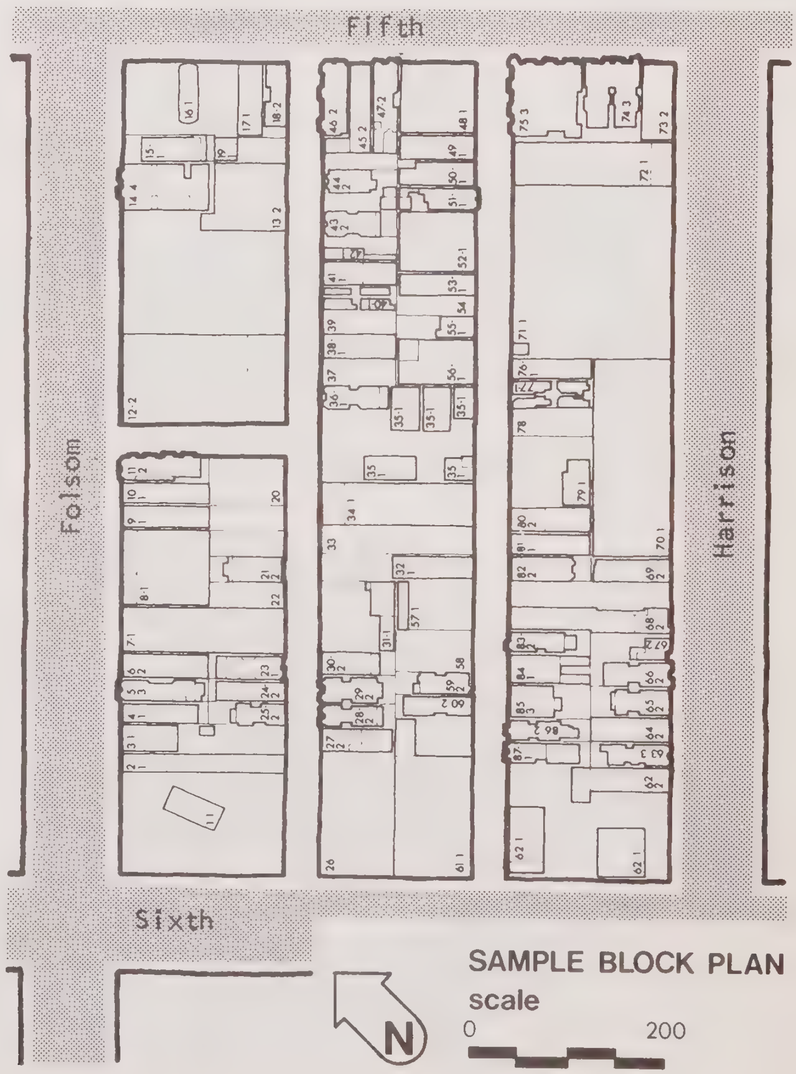


descriptive summation

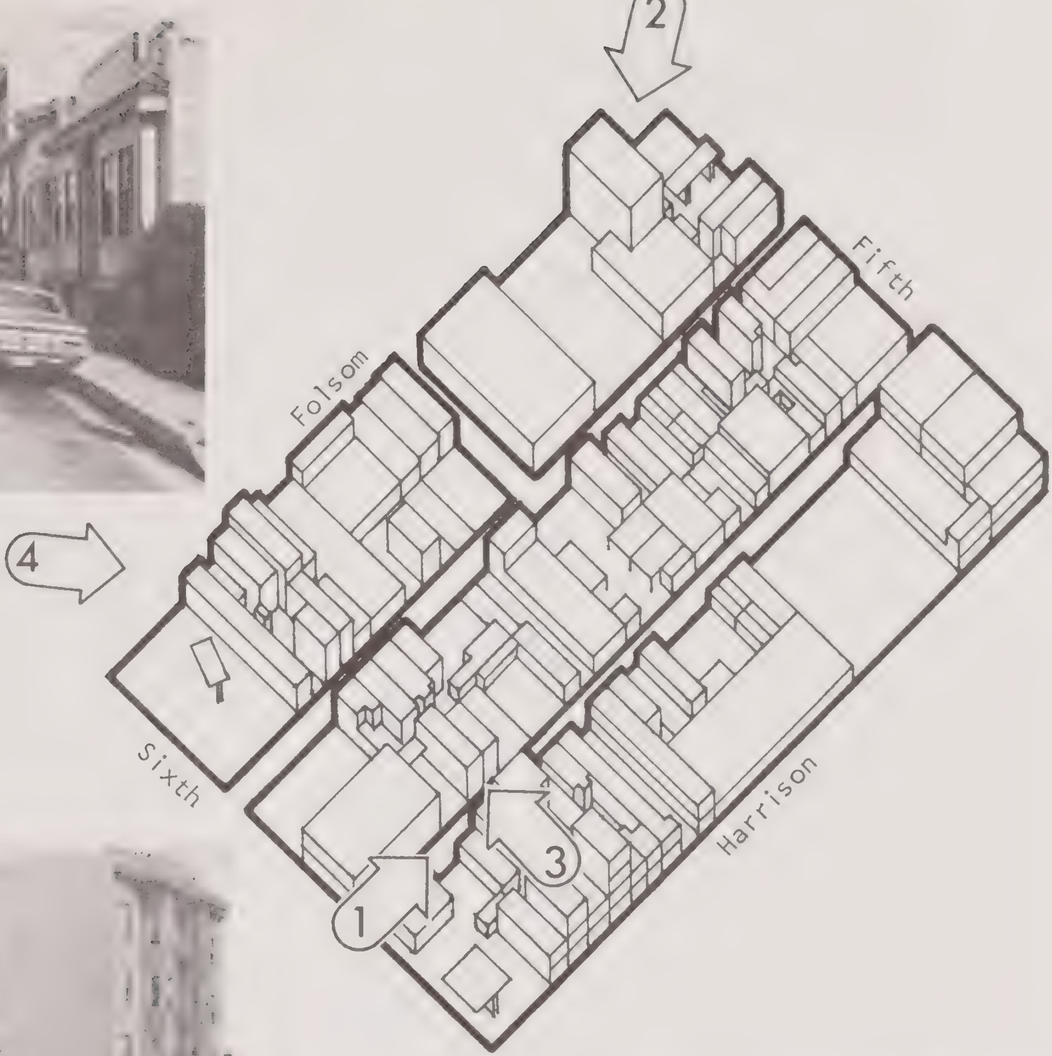
use	-industry,store and residential
height	-2-3
number of blocks	-north of Market 2 south of Market 27 total 29

sample block description
block 3753

major uses	-industry and residential
building area	-312,757sq.ft.
block area	-550x825 = 453,750sq.ft.
block coverage	-45%
block FAR	-.69:1
median height	-1 floors
highest building	-4 floors
average age	-1911(1880-1965)
comments	



1 Within Block



SAMPLE BLOCK ISOMETRIC
scale
0 200
N

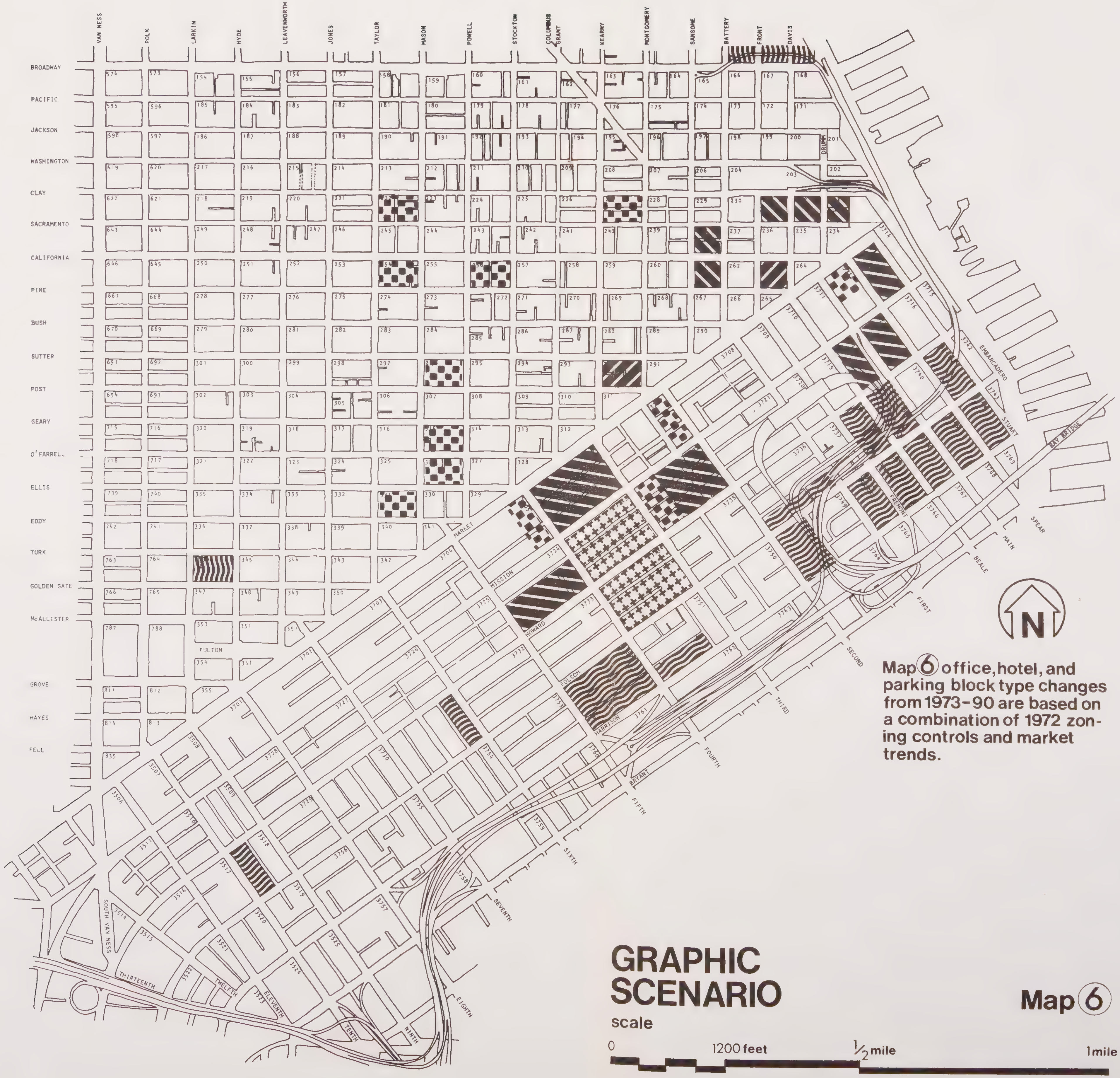
2 Folsom-Fifth

3 Within Block

4 Folsom-Sixth

KEY

- office
- hotel
- parking
- special



Map 6 office, hotel, and parking block type changes from 1973-90 are based on a combination of 1972 zoning controls and market trends.

GRAPHIC SCENARIO

Map 6

Block Description:

Median Height: 2 St. Highest Building: 48 St. Major Uses: OFFICE

Lot No.	Lot Area	Typical Floor Area	No. Floors	Bldg. Ht.	Total Bldg. Area	F.A.R.	Date Built	Age	Age X Area / 1000	Residential	No. Dw. Unit	Stores	Office	Hotel	Wholesale	Industrial	Warehse	Parking	Park	Freeway	Other	Desription of "Other"
1	11504	—	48	840	46422[illegible]	[illegible]	72	.5	232.1			12100	45212[illegible]									
2	7354	7350	3+P	50	23650	3.22	10	62	1466.3			7350	16300									
3	3136	3136	2	22	6272	2.0	10	62	388.86			3136									3136	VACANT (OFFICES)
4	6286	6286	9	104	56574	9.0	30	42	264.01			6286	50288									
5	3260	3260	2	28	6520	2.0	08	64	417.28			6520										
6	6692	6550	4	54	26200	3.92	07	65	1703.0			3550	19650		3000							
7	1461	1280	2	23	2560	1.75	10	62	158.72			2560										
T					585997				4653.92			41502	538359		3000						3136	
%					100							7	92		1/2						1/2	

Block Area:
275 x 412.5 = 103969

Block F.A.R.:
585997 ÷ 103969 = 5.64

Average Age: 1964
4653920 ÷ [illegible] = [illegible]

Total Bldg. Area	Area Above:	Office
444113	5 st.	444113
300085	10 st.	300085
226017	15 st.	226017
165463	20 st.	165463
117060	25 st.	117060
79450	30 st	79450

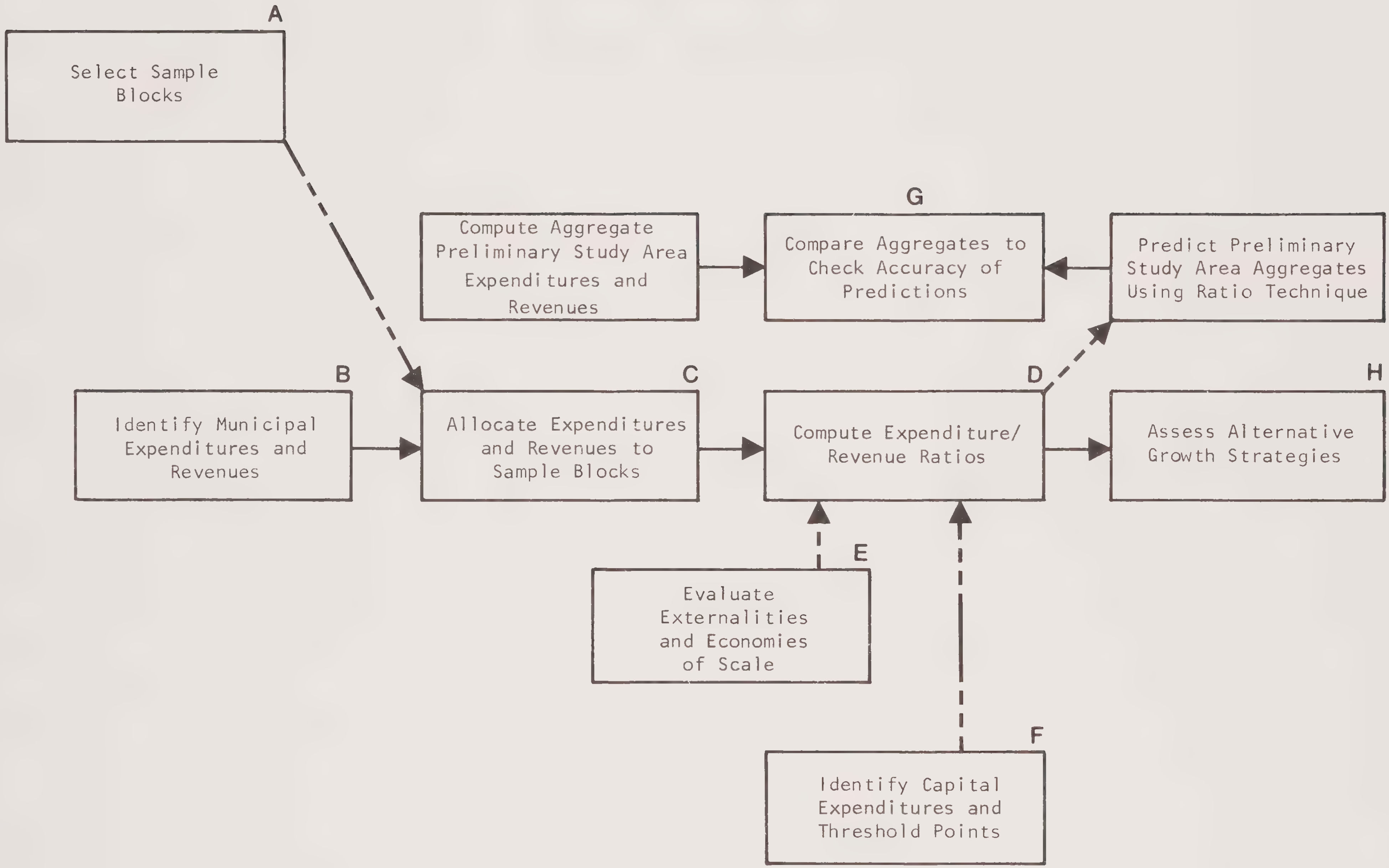
4.2.5

Generic Block Description Form

Block Number: 207 Bounded By: WASHINGTON CLAY SANSOME BATTERY

II. MUNICIPAL FINANCE

MUNICIPAL FINANCE
WORK FLOW DIAGRAM



MUNICIPAL FINANCE

Objective

The primary objective of the municipal finance analysis is to establish a mechanism for assessing the impact that continuing high-rise development will have on the municipal finances of the City and County of San Francisco. When this mechanism is established it will be used to help determine which of several alternative growth strategies would be "best" for San Francisco from the standpoint of municipal finance. It is intended that the mechanism derived will be capable of generating reliable ordinal values vis a vis the municipal finances of a given alternative. That is to say, we shall be able to rank order various alternative growth strategies on a most-surplus or least-loss criteria. Optimistically speaking, eventualities may be such that we will be choosing from several growth strategies, all of which yield more or less surplus. On the other hand, we may be faced with less optimistic realities such that our choice will be among several growth strategies, all of which yield more or less of a deficit. In any event, the municipal finance mechanisms will be capable of producing ordinal numbers which will facilitate "more than/less than" choices, thereby aiding those who would make growth strategy decisions, be they public servants, private investors, taxpayers or urban scholars.

Methodology

As we indicated in SPUR Report 1-A, the cost-revenue approach is the most feasible for undertaking this study. In the cost-revenue approach, major municipal expenditures and revenues are analyzed and, in this study, attributed to specific city blocks which vary in land usage, building intensity and location. We have chosen to use a single fiscal year (1970-1971) instead of a time series because of constraints imposed by data availability, data comparability, time and budget.

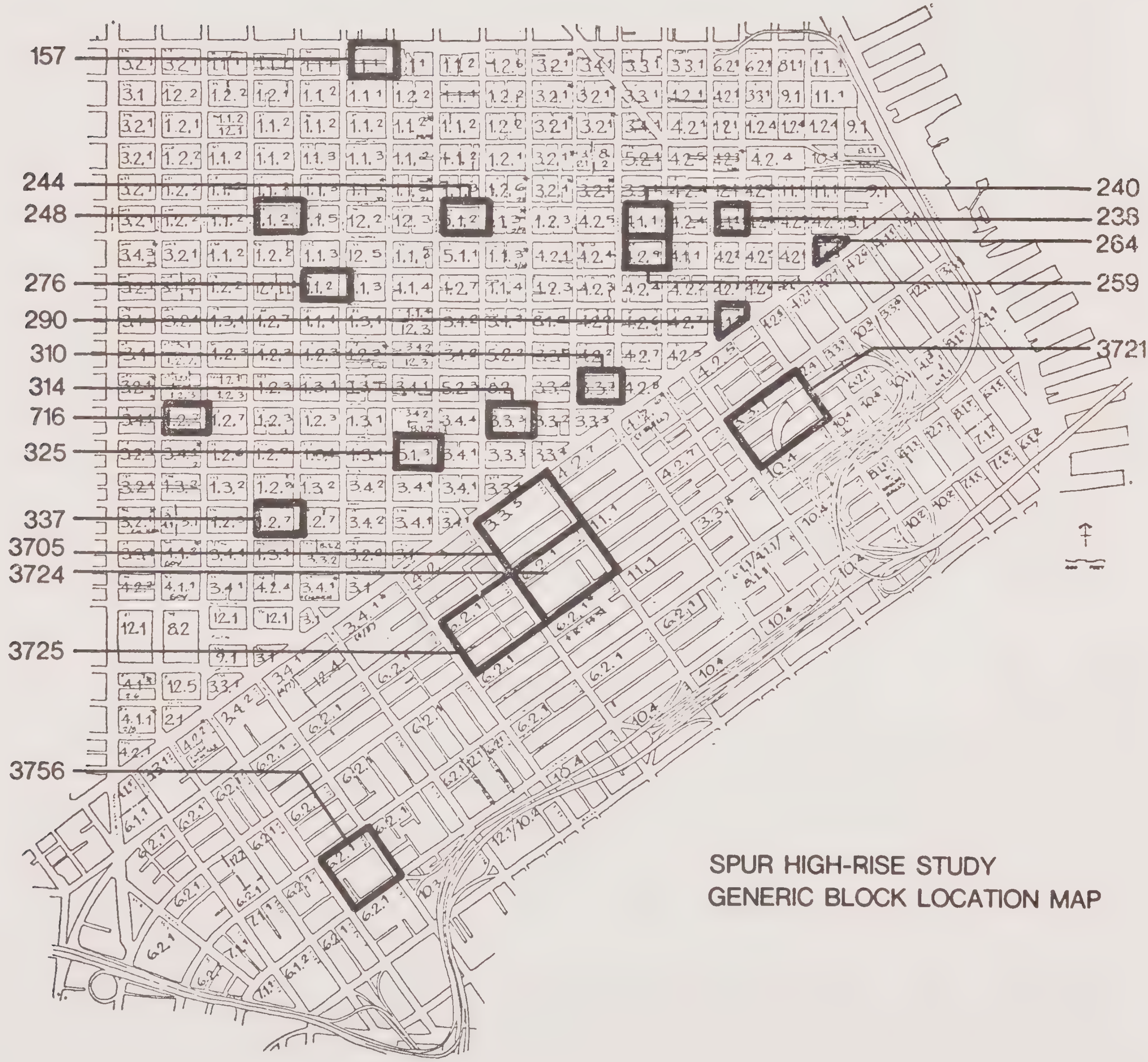
A. Municipal Expenditures and Revenues for Fiscal 1970-1971

Specifically, the analysis will be accomplished by following an eight-step methodology. In step A we identified aggregate municipal expenditures and revenues for fiscal 1970-1971 and have chosen the categories below for intensive investigation as these categories account for the bulk of expenditures and revenues.

Expenditures:	
General Government	$ 32,022,058
Police	31,178,638
Fire	25,418,281
Public Welfare	150,650,259
Schools	118,165,793
Total	$357,435,029

SPUR HIGH-RISE PRELIMINARY STUDY AREA

SELECTED SAMPLE BLOCKS BY MAJOR LAND USE



SOURCES: Urban Economics Division of Larry Smith & Company, Inc.
Kaplan and McLaughlin

In addition, the Municipal Railway deficit of $22,793,744 will be considered as a major municipal expenditure.

Revenues:	
Taxes on Real & Personal Property	$267,921,106
Business Taxes	7,207,559
Hotel Room Tax	4,042,356
Retail Purchase & Use Tax	23,636,370
Parking Tax	3,915,034
Utility Users' Tax	5,587,106
Employers' Payroll Tax	8,589,189
Total	$320,898,720

B. Selected Sample Blocks by Major Land Use

In step B we have preliminarily selected some sample blocks from the study area so as to include major land uses such as office (medium- and high-rise), retail, hotel, residential (low- and high-rise), and mixed use. In all, we are sampling 19 blocks representing these land uses. We have selected these blocks on the basis of the generic block concept developed by the consultants, but we have endeavored to select blocks which are essentially homogeneous in land use function. That is, we selected blocks that were being used predominantly for office, retail, hotel, and residential purposes, or otherwise representative, such as mixed-use South of Market blocks (see map attached).

C. Allocation of Major Municipal Expenditures and Revenues by Selected Blocks

In step C we have begun allocating the major municipal expenditures set forth above to each sample block. We are using a number of allocation criteria to determine the dollar amount of municipal services that a given block receives and the dollar amount of tax revenue that a given block generates. When possible we are identifying expenditures and revenues on the basis of actual services received by address or taxes paid by address. However, when it is not feasible to allocate by address we are using other allocation criteria such as assessed valuation, retail sales, utilities consumption, traffic generation, employment and population. For example, police expenditures can be allocated on a block basis, but we must rely on several sampling and estimating techniques as criminal records are numerous and police services are not recorded by address except when an arrest is made or a crime is reported and an officer responds. The "police product" consists of patrolling, criminal investigation, traffic enforcement, and overhead such as administration, training,

and planning and research; and most of these expenditures must be allocated by estimation. That is, by sampling address-specific police service data we can determine the incidence of criminal activity on a given block and can allocate other police service expenditures accordingly. The allocation of other major expenditures is being accomplished on a basis similar to police expenditures with some reliance on other allocation criteria as required.

The allocation of taxes on real and personal property has been accomplished strictly on an address-specific basis given the concrete nature of the data. However, when allocating other taxes such as retail sales taxes and utility users' taxes we shall rely on allocation techniques other than "address," such as retail sales and utilities consumption.

D. Expenditure/Revenue Ratios

In step D we will develop expenditure/revenue ratios for each major land use by square footage of use. This process will occur after all major costs and revenues have been allocated by block and coincidentally by major land use.

The construction of expenditure/revenue ratios by major land use is anticipated to be a fairly simple process. Remember that we have chosen blocks that are predominantly homogeneous in land use in order to simplify the process of converting the expenditure/revenue ratios to square footages by major land use. Square footage data is being compiled and will constitute a vital input to the expenditure/revenue ratio construction. After we have totaled the respective expenditures and revenues which have been allocated to each block, we can divide the expenditure and revenue values by respective land use square footages and we will have expenditures and revenues per sq. ft. By setting expenditures against revenues, the ratios will have been developed. For example:

$$\frac{\$1{,}000 \text{ expenditure}}{100 \text{ sq. ft.}} = \$10 \text{ sq. ft. expenditure}$$

X Land Use

$$\frac{\$10{,}000 \text{ revenue}}{100 \text{ sq. ft.}} = \$100 \text{ sq. ft. revenue}$$

The expenditure/revenue ratio in this case would be $1.00/$10.00 per sq. ft. of X land use.

E. Economies of Scale and Externalities

We will evaluate the effects of economies of scale and externalities in step E. When considering "economies of scale" we are in effect dealing with questions of size (bulk and height); that is, do large buildings (other things being equal) have more favorable expenditure/revenue ratios than small buildings from the point of view of municipal finance? When considering "externalities" we are in effect dealing with neighborhood questions. That is, do blocks with identical land use (similar sizes) but with different surrounding land uses have different expenditure/revenue ratios? In the study process we will isolate the various effects of bulk, height and surroundings on expenditure/revenue ratios. Blocks with similar land uses, bulks and heights but with different surroundings will be compared. Next we will compare blocks with similar land uses, heights and surroundings but with different bulks, and so on until the economies of scale and externalities on expenditure/revenue ratios have been evaluated.

F. Capital Improvement Expenditures and Threshold Points

In step F we will determine major capital improvement expenditures and threshold points and incorporate the value derived into the expenditure/revenue ratios.

For the purpose of this study we will focus on bond redemption and interest expenditures for the City and County of San Francisco, excluding most public service enterprises[1]. We have identified bond redemption and interest requirements in the near and long term. We are in the process of refining these aggregates and preparing a functional bond redemption and interest expenditures statement.

A capital improvement threshold point expenditure statement also is being prepared. This statement will parallel the bond redemption statement and contain annualized threshold point expenditures for the near and long term. The expected costs, required dates and life expectancies of such major items as new freeways, bridges and pipelines will be estimated in consultation with knowledgeable public officials and business leaders. Appropriate threshold point data will be quantified based on the information gleaned above and converted to an annualized basis by function.

1) Bond redemption and bond interest expenditures for all public service enterprises, except the Municipal Railway, will be excluded as most public service enterprises are regarded as private market entities and are self-supporting (see SPUR Report Part 1-A, Page III-16).

Next, a summary statement of expenditures by function will be prepared combining bond redemption and interest expenditures; and, annualized capital improvement threshold point data. Finally, this information will be incorporated into the aforementioned expenditure/revenue ratios.

G. Aggregate Municipal Expenditures and Revenues for the SPUR Study Area

The aggregate expenditures and revenues which will be derived in step G of the study are intended to provide a benchmark for determining the accuracy of aggregates predicted by the expenditure/revenue ratio technique. By comparing the two sets of aggregates we can isolate disparities and make adjustments accordingly. While this is step G in a logical sequence, this work task will be accomplished simultaneously with steps A-F, being undertaken by another analyst.

To further ensure that the aggregates derived in this section are independent from those to be predicted by the ratio technique, we are proceeding deductively in this part of the study. That is, we are working toward study area aggregates by proceeding downward from overall city and county totals. In the ratio case, the reader will recall that we are working toward study area aggregates by proceeding upward inductively from block totals.

As in step C, we will be compiling aggregates for: (1) General Government, (2) Police, (3) Fire, (4) Public Welfare, (5) Schools, (6) Municipal Railway, (7) Taxes on Real and Personal Property, (8) Business Tax, (9) Employer's Payroll Tax, (10) Hotel Room Tax, (11) Retail Purchase and Use Tax, (12) Parking Tax, and (13) Utility Users' Tax.

H. Assessment of Alternative Development Growth Strategies

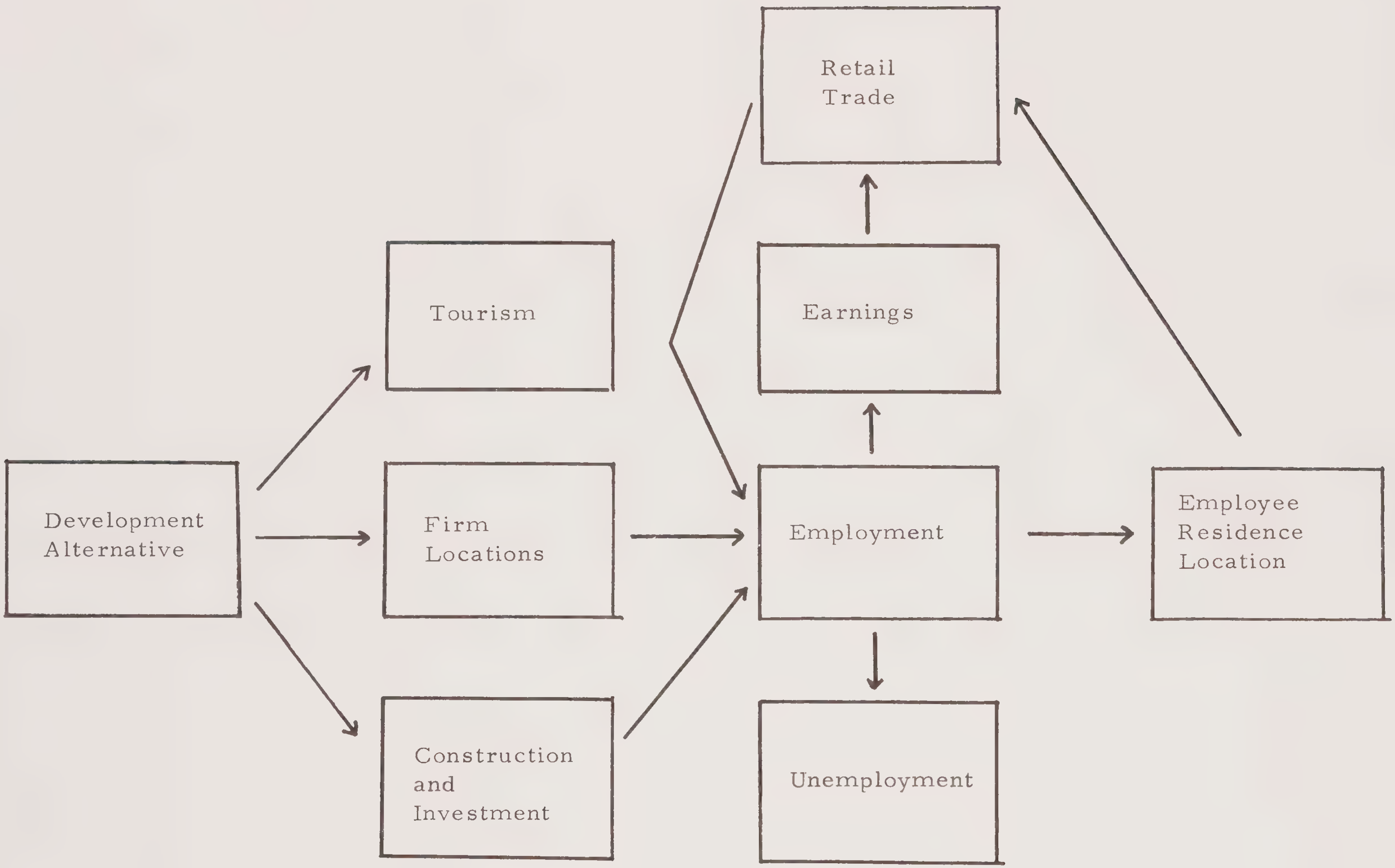
Finally, in step H, the assessment of alternative growth strategies, will occur. At this time the expenditure/revenue ratios and related absolute expenditure/revenue data developed in step D will be applied to alternative growth strategies in an effort to rank order the various strategies on a most-surplus/least-loss criteria.

With the aid of expenditure/revenue ratios we can assess which growth strategies are most desirable, provided that major land use square footage data are included. For example, if X land use has an expenditure/revenue ratio of 1:3 and Y land use has a ratio of 1:6, it would behoove us from the municipal finance point of view to choose the growth strategy possessing more of land use Y than of land use X.

From the absolute expenditure and revenue data that we will possess (with adjustments for minor expenditure categories not previously allocated) we can estimate aggregate expenditures and revenues related to each growth strategy.

In conclusion, we are of the opinion that the municipal finance section of this study is feasible.

III. URBAN ECONOMICS



Flow Diagram for Business Activity and Employment and Earnings

URBAN ECONOMICS

A. BUSINESS ACTIVITY

In this chapter we present the test of our methods for analyzing the effects of various development alternatives on business activity in the city. We group these effects into four major categories: Firm Locations; Retail Trade and Personal Services; Construction and Investment; and Tourism.

1. Firm Locations

The basis for this analysis is the hypothesis that different development alternatives will affect business activity in different ways. For example, higher density or high-rise development affects business activity differently than does an alternative form of development by causing a different mix of firms to locate within the city bounds. We are interested in determining what firms will do business in San Francisco under various development alternatives in order to note the effects on the type of economic activity which takes place in the city, the type and quantity of city jobs and the impact on investment and earnings of the various participants in the city's economy. Given that our objectives all deal with a change in the present situation, what we are interested in determining is which firms will leave and which will come under the conditions imposed by each of the given development alternatives.

The basic method which we will use to analyze the effect of a given development alternative involved two preliminary procedures. First we identified types of firms whose locational decisions are sensitive to the conditions altered by development alternatives. Second, we identified the various parameters which describe a location. We are only interested in those parameters which are both affected by a development alternative and which are a consideration in a firm's locational decision. We have concluded that firms should be typed by their SIC code, and by kind of space occupied (office, manufacturing, or retail). We have also concluded that the key locational parameter to consider is the strength of a firm's desire to locate in the Central Business District (CBD).

Because we are interested in development of the CBD in this study, most of the analytical framework developed to analyze the impact of development on the location of firms deals with office firms. The framework for analyzing the impact of a development alternative on these firms has three main parts. The first is a model of the supply and demand for office space in the CBD under a given development alternative. In the model we hypothesize four main sources of demand for office space in a given year: 1) existing tenants expanding their space requirement; 2) new tenants moving from other cities; 3) new tenants emerging from

start-up business ventures in the community; 4) existing tenants in buildings forced to relocate because their present office space is being removed. We hypothesize five main sources of supply: 1) existing tenants going out of business; 2) existing tenants reducing space requirements; 3) existing tenants moving to other cities; 4) new office space added, and 5) vacant space available from the previous year. Using the model we can determine whether a certain development alternative will result in excess demand for office space, causing rents to rise.

The second part of the framework involves an analysis of who will locate in the CBD under various office supply constraints. Based on our study of which types of firms will leave the CBD and then the city entirely, we note, for example, that holding and investment companies, security brokers, and business services have a strong desire to be in the CBD.

Third, we generalize our analysis to the city as a whole. We consider the supply and demand for office space outside the CBD under various development alternatives and note when pressure on space will arise.

Unlike office firms, retail firms of various types are considered together as one type of economic activity. The impact which retail firms have on the employment structure does not depend on the type of good sold, and therefore, we will consider retail firms (SIC 51-59) as a whole and will not analyze the competitions for space among the various types.

Finally, as in the case of retail firms, we will not anlyze competition for industrial space in detail. Such an analysis is unnecessary because of the small amount of industrial activity in the CBD (our major area of concern) and because of the declining role of industry in the city's economy.

2. Retail Trade and Personal Services

This section is an analysis of the effect of various development alternatives on retail spending in San Francisco. Any development alternative can affect retail trade in three different ways. First, a development may have an impact on the number and occupations of workers commuting to San Francisco, directly affecting retail spending by non-San Francisco residents. Second, a development may also affect the number and occupations of workers living in San Francisco. Any changes in the numbers or occupations of San Francisco residents will have a direct effect on their retail spending in San Francisco. Third, retail spending by residents and non-residents alike may be influenced by changes in the environmental conditions of San Francisco.

We will analyze these effects using three separate methods. In order to calculate the impact of a development alternative on retail spending by

commuters, we have developed a survey to estimate the amount which commuters spend in San Francisco as a direct result of the fact that these commuters are working in San Francisco and not in their city of residence. We will estimate spending by San Francisco residents using updated Bureau of Labor Statistics data. Finally, we will determine how peoples' shopping patterns are affected by the environmental conditions in San Francisco, using a separate portion of the commuter survey.

3. Construction and Investment

The basic purpose of this section is to trace the earnings accruing to various participants in the development of high-rise buildings. These earnings can then be considered with the employment wages gained or lost due to the different levels of construction and economic activity associated with different development alternatives.

The earnings of major participants in a high-rise development vary widely according to the particular financing scheme used and the conditions of the markets for funds and for office space. We will not attempt to predict all of these factors for each development alternative. We will instead use one typical financing scheme to represent the distribution of earnings for all development alternatives. Using this method, we will predict the magnitude of earnings accruing to each participant in any development, and make comparisons of earnings associated with various development alternatives. The method was tested by cross-checking various structures of financing schemes with several sources and selecting the one which was determined to be the most representative.

4. Tourism

For the purpose of the present study, the tourism question is largely an economic one: how do high-rise buildings and alternative developments affect visitors' contributions to San Francisco's business and earnings. We will study this question in the following way: First, we will use the Oestreich & Wassenaar survey to determine those high-rise affected environmental factors which various types of tourists particularly like and dislike about San Francisco. Second, we will note the effect of the various development alternatives on the environmental factors to which each type of tourist is sensitive. (These effects will be determined in the environmental section of the study.) For example, a large percentage of the business tourists may list traffic congestion as a feature of San Francisco which they dislike. If we note from our study that a certain development alternative causes an increase in traffic congestion, we can conclude that the alternative will adversely affect business tourism. A result such as this is not qualitative to the degree that we would like, but it is important in that it is at least indicative of whether the effect is positive or negative.

We will determine the importance of these factors on visitors who are here for business, vacations and conventions, since tourists who visit

the city for various purposes affect different sectors of the economy to different degrees.

B. EMPLOYMENT AND EARNINGS

In this chapter we present the test of our methods for analyzing the effects of various development alternatives on employment and earnings. We do so by grouping the effects into four categories: Quantity and Types of Jobs; Employee Residence Location; Earnings; and Unemployment.

1. Quantity and Types of Jobs

The quantity and types of jobs created by a development alternative result from four main factors: a) the locational decisions of firms; b) effects of these decisions on retail trade; c) construction activity; and d) building maintenance activity. The main source of data used in the analysis has been recently obtained from the Equal Employment Opportunity Commission (EEOC), and it will be used to relate the type of firms affected by a development alternative to type of workers employed by these firms.

a. Locational Decisions of Firms

The methods for analyzing locational decisions of firms are discussed in the section on Business Activity. Based upon firm locational decisions, we will estimate the quantities and types of jobs generated or lost. We will relate estimates of office floor space occupied by various industries to the numbers of office and non-office employees working in those industries according to the methods discussed in Firm Locations, Chapter A.

b. Retail Trade Employment

The purpose of this section is to derive the change in employment in the retail trade sector using data on a change in retail sales. Generally, the change in the spending on any commodity will affect the number of people employed in selling that commodity. We will analyze this interaction for each commodity and each type of store separately.

The first step will be to sum the development-induced changes in spending by commuting San Francisco workers with the changes in spending by San Francisco residents, for each commodity. This sum represents the total change in retail spending in San Francisco for each commodity, for any particular development alternative.

Second, we will determine from Census data the percentage of spending for each commodity which goes to payrolls.

Third, by multiplying the changes in dollar purchases of each type

of good and service by the payroll proportion, we calculate the change in retail sales payroll which results from a development alternative.

Fourth, we will convert this aggregate change in payroll to changes in the employment in each occupation by using wage data and the EEOC data. These calculations will produce the change in employment for each occupation in terms of both numbers of people and payroll. Finally, we will use the EEOC data to determine the race and sex characteristics of those retail employees affected by a development alternative.

Our method of analyzing the impact of a development alternative on retail employment is straightforward. Although the calculations are complex, they are direct. Therefore, the "test of the method" consists of insuring that the necessary data is available and useful. We have obtained all the data needed for our analysis and the data is now in a form ready to use. We have checked its applicability by doing all the calculations on sample data.

c. Construction Employment

One of the employment groups most affected by differences in development alternatives is that of construction workers. Our purpose in this section will be to estimate the changes in employment of construction workers due to the level of construction activity associated with various development alternatives.

Our method is to proceed from a change in the square feet of office space being built to the effect on construction employment in several steps. First, the change in square feet of office space associated with any development alternative is derived in the section on Firm Locations in Chapter A.

Second, this amount of square feet is converted to construction costs using a cost per square foot ratio. For this ratio, we will use $30/square foot. This figure is a composite of estimates from general contractors, a banker, and the "Northern California Real Estate Report."

Third, we will convert this estimate of total construction costs to on-site labor costs by multiplying total costs by labor's share of total costs. We will use 25 percent as an estimate for labor's share. This figure is based on discussions with several general contractors.

Fourth, by dividing the total labor cost by the average wage per hour, we will derive the hours worked. Our wage information is from the 1970 Census of Population, "Detailed Characteristics," and is discussed in the section on Earnings, <u>infra</u>. We expect this data to be published in March, 1973.

Finally, we will convert total hours worked to man-years by dividing the hours worked by the average hours worked per year. We

have used Bureau of Labor Statistics data and information from general contractors to derive an estimate of 1700 hours worked per year.

Once we have determined the number of construction jobs which will be created by a given development alternative, we will use the EEOC data to determine the occupation, race, and sex characteristics of the construction workers.

In order to test the accuracy of our data, we have discussed them with persons experienced in the construction industry. We have talked with general contractors, building appraisers, architects, and bankers. We have used published data wherever possible, for example, the "Northern California Real Estate Report" and the Bureau of Labor Statistics' "Compensation in the Construction Industry." To test the usefulness of the data, we have executed a sample calculation of the type which we will use in Phase III. We conclude that the data is suitable for our analysis of development alternatives in Phase III.

d. Maintenance Employment

Another employment group which is directly affected by the differences in development alternatives and is not included in the firm location section is that of maintenance workers. From the "1971 Office Building Experience Exchange Report," we have obtained labor costs per square foot for the maintenance of office buildings, by size and by height.

In order to note the effect of a development alternative on maintenance employment, we will simply multiply these costs by the changes in square feet in various sizes and heights of office buildings. By dividing this total labor cost by the wage rate, we can derive the change in employment of maintenance workers. By using EEOC data, we can determine the demographic characteristics of these workers.

2. <u>Employee Residence Location</u>

Once we have determine the number and types of jobs provided by the various development alternatives, we will analyze the resident-nonresident distribution of the employees. The methodology which we will use to determine employee residence is based on data contained in the Home Interview Survey conducted by the Bay Area Transportation Study Commission (BATSC) in 1965. In this phase of the study we have made special computer tabulations of the home interview data in order to determine the level of confidence with which it allows us to predict the percentage of commuters described by occupation, race, sex, and various combinations of these characteristics. We have found that the sample is large enough to allow accurate estimates of percentage of San Francisco employees who commute in terms of occupation and race and also in terms of occupation and sex.

3. Earnings

The purpose of this section is to describe how we will analyze the effect of various development alternatives on the earnings of San Francisco workers. We will multiply the changes in employment of various occupations (as a result of the impact of the various development alternatives) by the earnings for each occupation to develop the changes in earnings for the respective occupation. Our data will be detailed by race and sex to provide information for subcategories of the population.

Generally, we will use Bureau of the Census data on income by occupation for each race and sex. We have already obtained data from the "1960 Census of Population - Detailed Characteristics" and will analyze that data with the 1970 data to project trends in wages. We will use the Bureau of Labor Standard's Consumer Price Index for the San Francisco-Oakland SMSA to adjust these earnings data to constant dollars, and our analysis of the impact of any future development alternative will be based on this trend projection of real wages. The 1970 data for the San Francisco-Oakland SMSA will be available in March, 1973, in the "1970 Census of Population - Detailed Characteristics, California."

The calculations used in our method are straightforward and represent a standard method for this type of analysis. The "test" of the method is whether or not we can actually obtain the necessary data in a useful form.

According to the U.S. Department of Commerce, the 1970 data for the San Francisco-Oakland SMSA will be available by March, 1973, before the beginning of Phase III. We have determined its format from examining analogous data from other states, and we are satisfied that this format is suitable.

4. Unemployment

The occupational characteristics of the San Francisco unemployed are available for 1970 and have been tabulated by occupation, sex and race. Based upon the analyses which we will develop to evaluate the economic conditions of the various development alternatives, we will determine a similar profile for the type of jobs generated for each alternative. Then by comparing the occupational characteristics of the unemployed with the profile of potential employment generation, we will indicate the relative potentials for the various development alternatives to reduce unemployment.

Although we will be able to match the skills for the jobs demanded with the skills of the unemployed worker supply, the competition for those jobs will include non-residents and even immigrants who may fill the job vacancies before unemployed San Franciscans. Therefore, we will be unable to determine the absolute reduction in unemployment which might

be induced by a development alternative. We can only indicate the extent of the "pressure" which each alternative will exert to reduce unemployment. The method of matching job skills demanded and supplied requires no validation. It is simple and straightforward. However, the methods used to forecast job generation for the development alternatives are complex and are discussed in detail in the section entitled, Quantity and Types of Jobs.

C. TRANSPORTATION

The efforts in this section of the project have been directed at developing and testing methodologies for measuring the volume and cost impacts that various land uses and levels of intensity of development have upon the urban transportation system. The methodologies suggested in Report 1-A have been evaluated with respect to the quality of data which is available, and where necessary, the methodologies have been altered and redesigned so as to facilitate the use of existing or survey data.

Three areas of transportation are being studied for high-rise impacts. These areas are: (1) trip generation, (2) traffic volumes and flows on different parts of the transportation network, and (3) the costs of high-rise transportation demands.

For the first area, trip characteristics of seven land use categories (office, retail, hotel, warehouse, wholesale, industry and residential) and several block types have been analyzed. These characteristics are the number of trips, the time of trip, the mode of travel, the trip purpose, and the distributions of trips within San Francisco and between San Francisco and the rest of the Bay Area. In this analysis, simple methods have been developed which estimate the trip characteristics for each land use or block type which represents a combination of land uses.

The second area involves determining the current volumes of traffic on primary vehicle routes and estimating the increment of high-rise related traffic on those routes. The existing traffic volumes on the selected routes have been determined using traffic flow maps. A simple method is then developed which allocates to selected routes a portion of the estimated number of vehicle trips between the high-rise district and the other sections of San Francisco or the surrounding Bay Area communities. The capacities of the selected routes are then estimated using standards selected through the help of the San Francisco Department of Public Works, Division of Traffic Engineering, and the Institute of Transportation and Traffic. In a similar manner, the trip volumes on other transport links, such as mass transit lines, can be estimated and related to their capacities. Having determined the capacity of routes and a method for allocating increases in trip volumes, routes with potential for congestion can therefore be identified in the future scenarios.

The third area concerns estimating various cost parameters of providing and maintaining the urban transportation system in terms of the high-rise transportation demands. Increases in traffic or trip volumes due to land use changes such as high-rise development raise

maintenance and other costs on particular routes, as well as stimulate the construction of additional freeways or mass transit facilities according to public policy decisions. Isolating that portion of total transportation costs which can be directly associated with high-rise development is difficult, but methods have been specified for determining particular costs of incremental increases in trip volumes along certain travel corridors from high-rise trip generation. More general methods are also able to indicate the high-rise share of the total cost of operating the San Francisco street or mass transit system.

1. Trip Generation

Two methods of determining the amount of traffic generated by various land uses or combinations of land uses and density levels were tested; (1) the standard land use approach and (2) the block type approach. Both methods involve the development of a series of ratio or percentage parameters between trip characteristics and their respective units of analysis. The primary difference between the methods is the difference in their units of analysis. The standard approach directly relates transportation to land use using either 1,000 sq. ft. of floor area (for non-residential use) and dwelling units (for residential use) as basic units of analysis. The block type approach is conducted for a city block and does not directly relate land use with transportation. The basic unit of analysis is the block type which represents a particular combination of land uses and density levels. The two approaches, however, are related in that the land use results for a particular block can be aggregated to produce the block type results for that block.

Results: The results of testing these two methods showed that the standard approach is limited by the lack of specific data for the complete development of parameters which are appropriate for San Francisco. However, this approach is superior to the block type approach to trip generation analysis because it directly relates land use to transportation and consequently provides more stable parameters. To overcome the data problem, a pilot survey was conducted to determine the feasibility of using carefully selected, sample survey data for determining the trip generating characteristics of each land use. The results indicate that a survey of moderate scale will provide sufficient data for the purposes of the high-rise impact study. Therefore, it is recommended that the standard land use method be utilized with sample survey data to estimate the trip generation characteristics.

CITY & COUNTY OF SAN FRANCISCO

TWENTY-FOUR HOUR TRAFFIC FLOW

ON PRINCIPAL STREETS & HIGHWAYS

1969 - 1972

NOTES

1 FIGURES SHOWN ARE ACTUAL 24 HOUR TRAFFIC VOLUMES TAKEN AT VARIOUS TIMES IN THE YEARS 1969 THROUGH 1972, UNADJUSTED AS TO AVERAGE DAILY TRAFFIC

2. LOCATION OF STREETS & FREEWAY RAMPS ARE DIAGRAMMATIC ONLY

3 MAJOR ONE-WAY TRAFFIC FLOWS ARE INDICATED BY DIRECTION ARROWS ⟶

4 WIDTH OF FLOW NOT TO SCALE

DEPT. OF PUBLIC WORKS
BUREAU OF ENGINEERING
DIVISION OF
TRAFFIC ENGINEERING

DRAWN BY YTF DEC 1973

2. Traffic Volumes and Flows

For this portion of the analysis, the major routes which link the high-rise district with other areas in the city and other Bay Area communities were selected based on traffic flow maps from the San Francisco Department of Public Works and a road survey conducted for this purpose. The volumes of traffic currently on these routes were then identified as shown on the facing map. These volumes are then to be used to develop a system of ratios allocating increments in high-rise traffic along a travel corridor to particular routes. The system of ratios is based on the assumption that if a particular route between the high-rise district and another area attracts more traffic than the other routes, it should be allocated a greater portion of expected future increments. (Judgment will be needed in some cases to adjust the system of ratios when non-high-rise traffic on a particular route is large enough to suggest that the route should receive a larger portion of the high-rise increment in traffic.)

Having determined the major routes and their probable incremental increases, the capacities of these routes are quantified so that the potentials for congestion can be determined. For this purpose, standards giving the maximum numbers of vehicles per lane per hour are used to indicate the capacity and these standards are readily comparable to estimated traffic levels.

Using similar methods, the trip volumes, incremental changes due to high-rise development, and route capacities can be analyzed for other urban transportation modes. There do not appear to be any major problems in utilizing these types of methods to relate the estimated trip generation characteristics to the volumes of the transportation network and subsequently to the flow capacity of particular routes.

3. Costs of High-Rise Transportation Demands

The identification of that part of transportation costs which are related to a particular land use or type of development is very complex. A comprehensive share analysis of the total costs of the San Francisco street and mass transit system is one approach which provides a gross estimate of high-rise transportation costs. Beyond this general cost, more specific transportation costs are maintenance costs and the costs of expanding or adding new channels of travel to the existing network.

The costs of maintaining roads and other transportation facilities are affected by the volumes of traffic utilizing the facilities. The proposed approach is to estimate a cost per vehicle for maintaining the transportation network. This cost can then be applied to the number of vehicles which are involved in high-rise related trips, producing an estimate of the high-rise assigned cost of maintaining a transportation network. The traffic flow maps employed in determining the total vehicles on city streets and costs of street maintenance in San Francisco have been supplied by the San Francisco Department of Public Works. From this data, the incremental costs per vehicle are derived for maintaining the existing transportation network.

The high-rise related cost of constructing new additional expansions to the existing network is much more difficult to identify than were the costs of maintenance. The need for network expansion is not normally created by one source alone, but rather by a multiplicity of needs and interrelationships. The approach that has been adopted is to estimate that portion of costs which may relate to high-rise traffic. This estimate is based on the proportion of the new facility's forecasted volume that is generated by a high-rise development according to the previous estimating methods.

As indicated by this discussion, a variety of usable and workable cost estimating methods are available. The particular methods to be used in the actual impact study depend on types of costs to be required in the analysis in order to measure the high-rise impacts.

In summary, general methods have been constructed which determine the volume and cost impacts of high-rise development upon the urban transportation system. These methods, while not being of the level of sophistication of the methods in the 1-A Report, are efficient and workable given the limitations of available cost data and carefully selected, sample, survey data on land use trip generation.

Furthermore, the methods are adaptable to modeling anticipated changes in travel behavior and public transportation policies as part of the future scenarios for alternative forms of development. This is possible by simply altering certain parameters of the methods to conform to the anticipated changes, and therefore estimating the high-rise impacts according to the changed conditions. They are also compatible with the procedures designed for the future scenarios and other outputs of the study in that the volume and cost impacts for various land uses can be aggregated to produce the total transportation impacts of a generic block type.

D. HOUSING AND LAND USE

This portion of the study will explore some of the ways in which high-intensity development in downtown San Francisco affects residential neighborhoods throughout the city. The broad conceptual model upon which our investigation is built has several parts.

First, as high-rise office buildings are constructed in the downtown, the nature and level of downtown employment changes. In the second step of the model, a portion of the additional employers present in the downtown will seek housing within San Francisco. Because of certain characteristics of these employees, they will seek housing in certain neighborhoods rather than others. Not all neighborhoods will be equally affected. In the third step, additional demand for housing in neighborhoods can have one or several of the following effects: (1) Rents increase as new residence seekers compete for space in the existing stock of housing units; (2) House values increase as a result of both increased demand for the housing units and increased probability that the housing unit can be demolished and rebuilt at a higher density; and (3) New construction at a higher density occurs in response to increased demand and higher rents.

The operation of these pervasive economic forces results in a change in the character of the affected neighborhoods. At the first level, the demographic character of the neighborhood may change. The new residents may have demographic characteristics that differ significantly from the previous residents in terms of age, family size, income, profession, ethnic identification and so on. The new residents may directly displace previous residents unable to compete with the higher rents paid by the newcomers, or the new residents may be a pure addition, inhabiting new housing on previously less densely developed land. Existing trends in the neighborhood may become even stronger; or entirely new trends may be introduced, i.e., single persons replacing families. If the effect is strong enough, that is to say, if the number of new residents is large compared with the number of previous residents and if the new residents do differ significantly in demographic terms from the previous residents, the phenomenon known as "neighborhood turn-around" might emerge.

A second result of the process that began with employment changes in the downtown might be what has been called the "ripple-out" effect. As employment goes up in the downtown, rents go up in the neighborhoods. The increased rents in the neighborhoods imply an increase in the value of existing housing units and in the value of the land upon which the housing stands. This phenomenon, if it can be shown to exist, would have different effects upon different persons. For the property owner, it means higher taxes for as long as he holds the property, but a greater

gross return on his initial purchase price, if and when he sells. For the renter, it essentially means higher rents and--unless compensated from other sources such as salary increases or tax relief--a net decrease in his standard of living. For the city, it means increased property tax collections. This revenue increase may or may not be offset by different costs and demands for city services, such as schools, police, etc.

A third result that might be traced back to the employment changes downtown is a change in the physical form of the neighborhoods. Increased demands for space and increased rentals being offered make demolition of existing housing and rebuilding at a higher density profitable for a private developer. At the first density level this could mean, for example, the demolition of single-family homes to be replaced by multi-family structures. At higher levels this could mean the replacement of medium density multi-family structures with high density multi-family structures--in other words, the emergence of residential high-rise.

In order to estimate the proportion of new employment that would choose to live in San Francisco, we began with an analysis of the historical retlationship between employment increases in San Francisco and the proportion that have chosen to live within the city. Our basis data sources were the 1960 and 1970 U.S. Census of Population and Housing, the 1965 Bay Area Transportation Study's Employment Inventory, and yearly employment estimates of the California Department of Human Resources Development. After reconciling the discrepancies between these varied sources, we concluded that for every three new jobs created in San Francisco's downtown during the 1960's, one job has gone to a person who chose to live within the city.

To investigate the distribution of these San Francisco employees among San Francisco's residential neighborhoods, we relied heavily on data in the U.S. Census. Our basic method was to compare the characteristics of downtown employees with the characteristics of employed residents in the neighborhoods. Additionally, the neighborhoods were described in terms of their distance from downtown and the type and cost of housing they provided. In general, we concluded that the residential choices of new employees could be fairly accurately predicted on the basis of a few variables: access, income, race, sex, and occupation. Given the downtown employment increase implicit in any scenario or development alternative, we can rank-order the neighborhoods in terms of the increased pressure on existing housing stocks that will be experienced.

We also investigated the feasibility of producing quantitative estimates of the effect of residential choice decisions on the key variables of housing value, rents, and construction activity. The analysis in this section is more complex because time series analysis is almost indispensable in order to control the effects of the many other variables that influence these economic impacts. Using graphic tehcniques, supplemented by simple, bivariate correlation analysis, we found that in many of the neighborhoods the results were generally consistent with our hypothesis. Increased CBD employment in those neighborhoods does appear to be associated with housing price increases and construction activity. In others there remains a great deal of unexplained variance.

The results do suggest that the basis approach will yield usable results, and more sophisticated analytical techinques, such as multiple linear regression, should produce the necessary reliability. Since these techniques are well known, and the data already identified and used will suffice, we believe that such an extension of what has been done is feasible.

To examine the role that high-rise buildings play in the housing market, we collected data from building permits, assessor's records, and private sources knowledgeable in the local market. Our data covers 70 market-rate residential buildings over 10 stores in height, well over two-thirds of all such buildings in the city. We found that the neighborhood locations of these buildings could be explained on the basis of zoning, access to the CBD, topography, and neighborhood prestige. We also found a systematic relationship between these same variables and dwelling unit mix, cost and tenure. Additionally, based on a sub-sample of 18 buildings, we were able to estimate the market premium placed on height within a building that is reflected in rent and, in the case of condominiums, cost. On the basis of this data, a straightforward extension of standard techniques of housing market analysis will enable us to predict where future high rise residential buildings are likely to be built under various alternative development controls, the kinds of housing opportunities they will provide, and the ways in which the residents are likely to differ from the previous residents of the neighborhoods.

IV. THE ENVIRONMENT

THE ENVIRONMENT

A. AIR QUALITY

High-rise building developments can induce an increase in the sources of air pollution by generating increased electric power consumption and motor vehicle traffic volumes. Their physical presence can also retard the dispersion of pollutants, a phenomenon known as the canyon effect. Our study treats both effects.

By forecasting the changes in electric power consumption, and vehicular traffic volumes for different development alternatives' commercial and residential densities and activities, and by relating these changes to their respective amounts of generated pollutants, we will estimate the air quality changes which will be induced by the various alternatives for the city and immediate region. (We will account for changes in transportation mode, emission standards, use restrictions, and technological improvements in making our estimates). We will also estimate local effects where particularly high concentrations might be expected to occur due to high density emission sources, the sizes and relationships of surrounding buildings, and particular micro-climatic influences. We will estimate future levels of pollutant concentrations for five to ten representative locations within the City to compare the various alternatives according to the different levels of air pollution density they are likely to produce.

We will use two different methods to estimate the air quality impacts of vehicle emissions and electric power generation plants.

The mathematical model we will use to project local air quality effects of motor vehicle emissions is part of the diffusion model developed at the Stanford Research Institute by Frank L. Ludwig and Walter F. Dabberdt to predict concentrations of inert, vehicle-generated pollutants in urban communities. The method has been extensively tested and validated in urban locations having conditions similar to those in San Francisco. It is the model currently used by the Bay Area Air Pollution Control District to predict local concentrations of carbon monoxide at locations in the Bay Area, and we feel that no further validation of the model is necessary before using it in our study. Although the model only directly predicts concentrations of carbon monoxide, Dabberdt and Ludwig showed in their tests of the model in San Jose and St. Louis, that reactive vehicle emissions, particularly hydrocarbons and nitrogen oxides, are highly correlated with non-reactive concentrations of carbon monoxide. Also, in a study for the United States Department of Health, Education, and Welfare, a team working on lead contamination established a high correlation between carbon monoxide and lead concentrations. Therefore, the relationships of carbon monoxide, lead, and other pollutants will be used to estimate all principal pollutant concentrations on the basis of carbon monoxide estimates derived from the model.

In their tests of the model, Dabberdt and Ludwig verified that pollutant entrainment varies directly with pollution emission rates and inversely with street width and wind speed. The model also indicates the canyon effect of tall buildings, since it shows that on the leeward side of the street, pollutant entrainment also varies according to the height of the observer and the height of buildings creating the canyon, so that the increase in pollution density rises rapidly with building height. We will specify pollution concentrations at 1.5 meters above the sidewalk on each side of the street. Therefore, the model will show the pollutant concentration which an average pedestrian walking along the street would experience.

We will discuss air pollutant emissions from electric energy generation as a range from virtually no emissions to those which might be expected if fossil fuel plants are used to serve increasing demands. We will make our estimates of maximum future pollutant emissions from power generation plants on the basis of the power generated and pollutants emitted from the existing plants as they were functioning in 1971. By forecasting the electricity required under the conditions of the various development alternatives, we will determine the corresponding volumes of pollutants that would be emitted in generating that electricity.

B. WINDS

The effect which a tall building has on the air flow around its face is determined by the size and shape of the building itself, as well as the sizes, shapes, and relative locations of buildings nearby. These physical conditions can combine to cause the wind velocities near the base of the tall building to be much greater than the wind velocities that would occur if the building were not there.

Although determination of the precise velocity and flow patterns around a specific building requires a complex analysis, the principles of the air flow patterns are relatively simple. Open plazas can have the effect of increasing wind velocities even more. On the other hand, buildings within sixty to one hundred feet of a tall building can serve to reduce the base wind velocities below those which would occur if the tall building stood alone.

On the basis of many wind tunnel tests which have been performed and compared with actual site investigations, engineers have learned which physical parameters are the principal determinants of wind direction and velocity at the base of tall buildings, and they have also determined the general relationships between these parameters and the velocity of air flows produced. We will apply their results to our analyses. We will express the physical configurations for the various development alternatives in terms of average building heights and floor areas for

each block in the study areas. We cannot "design" the individual buildings of each alternative, but general configuration information will be sufficient to produce some interesting conclusions. In a few instances we will speculate on the winds which might be produced under some reasonable building size and siting relationships.

In addition to estimating the velocity of winds induced by the alternative building developments, we will indicate what these winds imply in terms of the nuisance and discomfort they would cause. Based on research principally conducted in England, we know that at wind velocities of:

10-18 mph, dust is raised, loose paper is blown, and small branches are moved

25-30 mph, large branches are moved, umbrellas are used with difficulty

45 mph, people are unbalanced and seriously inconvenienced, and

over 50 mph, people are blown over.

We will also indicate the thermal or "wind-chill" effects of the winds forecasted.

C. NOISE

There are two principal noise sources which are attributable to building development, and which constitute the major part of background and peak noise levels in the urban environment. These are the noise of motor vehicle traffic generated by increased business activity and residents of new buildings and the noise of construction equipment employed for the building projects themselves. Other incidental sources are comparatively insignificant, relative to the sound levels generated by these principal sources.

We will project the noise levels incident to the different traffic volumes generated by each development alternative. We have conducted extensive research into the state of the noise prediction art to determine the feasibility of employing a projection model, and the availability to us of the necessary input data to implement the model. Our prediction technique is based upon a model developed by Bolt Beranek and Newman for the Highway Research Board, to predict noise levels generated by highway traffic. We have adjusted the model to adapt it to the traffic conditions of the urban traffic situation, since urban street conditions differ from highway conditions in that the former involve stop and go driving, as well as slower speeds, a smaller proportion of trucks to automobiles and sometimes steeper gradients than are normal for conditions of the open highway.

We undertook to count and record the composition of vehicle flows at two different sites, for both peak hour and offpeak traffic. Then we implemented the mathematical model to see if it would predict results close to the values we measured, for the same basic input data: traffic flows, composition, speeds, gradient, pavement, and distance from the roadway. Results from the two procedures were similar, and we are satisfied that the model is a valid predictive tool for our use.

Our method for forecasting construction noise is somewhat different. For each phase and duration of construction activity implied under a given development alternative, we can specify the range in dB(A) values which will be generated by the necessary equipment, as well as the amount of time the noise levels will remain in this range. Given the locations of construction activity involved in the different development alternatives, the size of the resident population, and the numbers of workers per square feet of floor space per block from the Block Analysis for the daytime worker and pedestrian populations, we will also calculate the numbers of people who will be exposed to these peak ranges for any given construction project under the different development alternatives.

D. SOLID WASTE AND WATER QUALITY

1. Solid Waste

The principal methods currently used for disposing of solid waste are incineration and dumping. Incineration emits large amounts of particulates into the air, while the biggest problem with dumping is finding enough space in which to dump the wastes produced over many years. Using solid waste as landfill can have both good and bad impacts on the local environment at and around the dump site.

Currently, virtually all of the 1300 tons per day of solid waste produced in San Francisco is hauled to a dumpsite in Mountain View. The remainder is burned either in twenty-seven apartment house incinerators or illegally in open fires, but this incineration is not great enough now to cause any significant impact on the region's air quality, (See Chapter A), and dumping is also likely to remain the principal method for disposing of solid wastes in the future. We know that at the current rate of waste production, all of the existing dumping sites in the Bay Area will be filled in about twenty-five years.

Using data from the two solid waste disposal companies in San Francisco, we will calculate the weight of solid refuse collected in 1972 from a sample of each of the block types that will be used to construct the development alternatives. From these data we will calculate the weight and volume of solid waste which will be generated

annually from each block type in each development alternative. By relating this annual volume to the total capacity of the remaining disposal sites, we will determine the use rate and the number of years within which each alternative will deplete the available space.

We have already investigated the availability of all necessary data concerning refuse volumes, and have determined the feasibility of computing the total waste generation of each development alternative either manually or by computer.

2. Water Quality

By multiplying the resident and worker populations resulting from the respective development alternatives by appropriate wastewater discharge coefficients, we can estimate the total discharge for any increase in the level of residents and workers. Then we can estimate the impact of these wastewater discharges on the water quality of San Francisco Bay by determining how much of each pollutant will be removed by various alternative treatment processes and comparing the estimated pollutant discharge from San Francisco with total discharges into the Bay from all other sources.

We will estimate the increase in pollutant emissions by using the waste coefficients published in the San Francisco Bay-Delta Water Quality Control Program, carried out by the California State Water Quality Control Board, and the Master Plan for Wastewater Management, developed by the San Francisco Department of Public Works. These coefficients are used by the San Francisco Department of Public Works in their analyses of pollutant emissions, and we feel that no further validation is necessary to justify our use of these coefficients to predict pollutant emissions from the development alternatives. We will also determine whether primary, secondary, or tertiary treatment of the various levels of waste generation will be necessary to keep discharges below the allowable limits of pollutants.

E. EARTHQUAKE HAZARD

The parameters which we can specify in characterizing a development alternative include only building heights and relative locations, and these factors alone are not pivotal in mitigating the extent of damage. Judicious placement of buildings can contribute to increased earthquake safety, but proper foundation design can compensate for poor soils and avoidance of earthquake hazard areas would then exclude most of the focal area of our study.

Because we are unable to ascertain the essential factors influencing

building integrity and people's safety for each development alternative, we are unable to compare alternatives according to their relative threat to human safety. Therefore, we conclude that the analysis of earthquake impacts should be eliminated from this study.

F. RESOURCE CONSUMPTION

The impacts of water and power consumption are inextricably tied to generation modalities, and these are regional issues. The integral information for considering the desirability or undesirability of consuming any given level of power or water, is to know how the relative demands will affect the total supply of the resource in the region under investigation. Knowing that one development alternative implies twice as much electricity consumption as another alternative, does not necessarily weigh in favor of adopting the latter alternative. Decision-makers would also have to know the relative preparedness of the various agencies within the region to supply the different energy demands in each locale of the entire region. Containment of demand increases in one part of a region may only contribute to moving demand increases elsewhere within the region. Moreover, the energy generation requirements to meet the demands of several localities may have greater impacts for these areas than would have been felt in supplying one locality. The regional impacts would have been beyond what San Francisco decision-makers could have foretold solely on the basis of their own alternative development consumption impact results. (According to Pacific Gas and Electric Company's Economics and Statistics Department staff, San Francisco presently consumes only four percent of the total electrical energy produced by the company in California. Thus the consumption differences between competing alternatives would be very small and comparatively insignificant compared with regional energy generation needs).

Extending the example, it may be that developments which are prohibited in the San Francisco Bay Area may locate in, say, Chicago, which may have its own particular regional energy-generation problems. That is, nuclear power generators may offer feasible and relatively more desirable means of meeting energy needs in some localities, but infeasible in others. If development ceilings in areas where desirable power-generators are feasible cause development increases in areas where such generators are not feasible, then environmentally undesirable power generation alternatives may have to be used in these localities.

To estimate the relative consumption levels generated by the different alternatives would only provide inadequate and incomplete information to assist in making responsible decisions between competing San Francisco development strategies. We do believe that the issue of resources consumption is a vital environmental concern. But it should be studied as an independent investigation, and on a regional basis.

G. VIEWS

In our analysis of the impact of alternative developments on views, we will estimate the quantity of views which will be available in each development alternative. We will also describe and illustrate with photographs some of the qualitative aspects of the views resulting from the different configurations of alternative developments. We will be analyzing viewpoints separately from the objects that will occupy the field of view.

A smaller percentage of building occupants who have unobstructed views may result from a development alternative with more high-rise buildings than would result in an alternative involving fewer high-rise buildings. We have developed a method to estimate the total number of viewpoints and the proportion of views which are blocked in terms of the different numbers, sizes, and relative locations of buildings in the different alternatives.

The width and depth of a field of view determines how much and how far a person can see from a given point, and both dimensions are affected by the presence of obstructions in the view. Apart from the aesthetic features of different views -- which will remain unquantifiable so long as there is no standardization of human taste -- a larger field of view is generally preferable to a smaller one. On the assumption that obstructions detract from a view, we can measure and quantify the components of the field of view for different generalized viewpoints and views in terms of the proportion of a given field of view which is unobstructed.

The Block Analysis used to describe the development alternatives will stipulate the height and bulk measurements of the buildings within each block as well as the position of each block. We will use this information to develop a set of maps showing the height of the buildings on each block, adjusted by the elevation of the block terrain, within each development alternative. We can then determine from these maps how much of the field of view from each of the viewpoints would be unobstructed. By adding the unobstructed views for each alternative, we can compare the expected number of available viewpoints offered by each alternative.

We will call the proportion of unobstructed area in any view a "view index" of that view. The view index is higher the greater the proportion of unobstructed area in the view. This index depends upon the definitions of "obstructed" and "unobstructed " area, which are necessarily subjective, but the overall subjectivity of the view index is minimized in that it does not attempt qualitatively to rank obstructions; it only records the amount of area they occupy in the total view.

(1) We will assume that any building within a mile of the viewpoint being analyzed acts as an obstruction, and that a building at a distance greater than a mile is part of the view.

(2) It is clear that a view direction perpendicular to a window is more valuable than a view at an oblique angle to the window and that the value diminishes rapidly as the angle approaches a parallel with the window. We will define perpendicular views as the most valuable and views at increasing angles with the perpendicular direction as being of decreasing values.

If the advisory committees indicate that our definitions should be altered, we will change our criteria accordingly. But no matter what definitions we ultimately use in the final analysis, our analytical procedure, results and conclusions will be presented in such a way as to allow any reader to impose his own definitions and follow our analysis method to reach his own conclusions regarding the proportions of unobstructed and blocked views for comparing development alternatives.

We will confine our study of view quality to a comprehensive presentation of photographs illustrating the content of representative views available from development alternatives. We will present wide-angle photographs to illustrate views of different indices from street level and various floor levels. In this way, our quantitative expression of views will be complemented with a corresponding qualitative representation. We feel these two presentations together will provide the reader with a basis for judging the relative view quantity and quality offered by respective development alternatives.

H. OPEN SPACE AND RECREATION

In this step of our study, we sought to test whether we could measure high-rise building impacts on parks in three ways. First, we wanted to learn whether the large number of residents of new high-rise buildings raises the level of demand for park space, and whether high-rise residents use their neighborhood park more or differently than low-rise residents. We also sought to learn if other building effects, such as increased traffic flows or shadows cast by the buildings, reduce the benefits which a park can offer to all its users. Third, we sought to test whether the presence of tall buildings around a park influences the impact area of that park (that is, the area from which park users come to the park). Perhaps the building would block visibility of the park or limit the distances people would travel to the park from points behind the building.

We designed a questionnaire to permit us to find out where park users came from and what they particularly enjoyed or disliked in a given park. We conducted interviews at Lafayette Park for three hours on a Sunday afternoon, and were able to interview 47 percent of those entering the park while we were there. We used two teams who moved around the park at set intervals, so that we sampled all park entrances equally within a relatively short space of time. Administration of the questionnaire

was quick, and we found it fairly easy to achieve unambiguous answers to all focal questions. We are satisfied that our sampling technique and questionnaire offer valid methods for application in Step 3 to a number of different parks and plazas in both commercial and residential areas.

We also determined that it will be possible on the basis of data from the Block Analysis to produce diagrams showing the shade patterns on and around parks which would result from the new buildings associated with various development alternatives.

I. TRAFFIC ACCIDENTS

An increase in the number of high-rise office buildings in downtown San Francisco may result in an increase of employment density in the area. Thus the number of people and automobiles converging into the central business district may increase, as perhaps may the occurrence of traffic accidents there. We will examine this hypothesis by analyzing traffic accidents for a set of major routes to the downtown (high-rise impacted streets), in comparison with a second set which do not lead to a densely populated section. The data to be used are: 1) twenty-four-hour and peak-hour traffic flows, 1965 and 1972; and 2) yearly traffic accidents by intersection by time of day, 1957-72. To normalize the number of traffic accidents in areas of light and heavy traffic, accidents will be expressed as a percentage of daily vehicle flow along the street on which the accidents occur. The ratios are: (No. accidents by intersection by year)/(Daily vehicle flow along the route for the same year).

To estimate the accident ratios for alternative block developments, a projection of future traffic flows will be made. The data to be used are: 1) ratios of floor space to vehicle trips generated for hotels, office buildings, department stores, and one-, two-, three-, and four-bedroom residences; and 2) traffic volumes compared with street capacity. The method for distributing the new traffic volume generated will be to assume the flows on each street maintain the same relationship to each other as the flows indicated by the 1972 Downtown Parking and Transportation Survey for San Francisco. We will also assume that the ratio of traffic accidents to vehicle flow continues the trend established in 1965 and 1972. Therefore, knowing the accident-to-vehicle-flow ratios for 1965 and 1972 for each intersection, we can determine the trend and estimate accidents for any future year from a forecast of the vehicle flow in that year.

We will photograph traffic conditions for several streets and superimpose the increased traffic flow to provide a visual illustration of the crowding anticipated. We will also compare these photographs to corre-

sponding graphs of accidents and accident-to-vehicle-flow ratios generated by greater building intensity.

J. PEDESTRIAN CONGESTION

Pedestrian flows in commercial and residential districts are determined by the activities and use intensity of those areas. The level of activity is a function of development density and floor space available for such activity, and therefore, the density of pedestrian traffic is a function of building intensity. We will analyze high and low density development areas to determine the relationship between pedestrian flows and the surrounding floor space by use. We will use three sets of data for the analysis: 1) ratios of employees to square feet of office space, shoppers and store employees to retail store space, and residence to residential floor space; 2) square feet of floor space according to use; and 3) pedestrian counts at morning and evening rush hours in areas having different amounts of floor space devoted to different uses.

We will also explore the relationship between pedestrian flows and traffic accidents involving pedestrians. By expressing pedestrian related accidents as a percentage of pedestrian (and vehicle) flow at representative intersections, we will determine how pedestrian-involved accidents are related to pedestrian (and vehicle) flows.

Finally, we plan to photograph intersections and superimpose the increased pedestrian flow generated by alternative block developments. This will provide a visual representation of the crowding anticipated. We will also relate flow forecasts and representative photographs to the volume of pedestrian flow at which free walking flow and conversation become impossible.

K. CRIME

On the basis of recent research focussed specifically on the interrelationship between crime and the design features of high-rise residential projects, we sought to scrutinize crime statistics of the San Francisco Police Department, to see if San Francisco records seemed to be consistent with the hypothesis that tall buildings offer conducive environments for certain kinds of crimes.

Because of data limitations, it is impossible to test this relationship conclusively. The areas for which the department maintains statistics by type of crime are too large to permit the discrimination of crimes occurring in or around particular buildings, or even in exclusively high-rise building environments. Moreover, the available data is insuf-

ficient to perform a sufficient time-series analysis for selected areas.

However, we will examine records back to 1968 of the incidence of certain crimes within a sample of police plots (a small, 4- to 6-block area), pairing a predominantly high-rise plot with a predominantly non-high-rise plot with similar use characteristics and located in the same section of the city. We will focus on particular crimes which have been signalled in the literature and indicated to us by experts as being potentially high-rise related. These crimes include rape, robbery, burglary, theft, auto theft and purse-snatching. We will compute an appropriate test statistic to use to determine if the mean number of each crime per year in predominantly high-rise plots is significantly different from the mean in predominantly low-rise plots.

In addition, we will also circulate a questionnaire to residents and workers in high-rise and non-high-rise areas to learn whether people's feelings of safety or insecurity are different between the two kinds of areas. The responses to this questionnaire will serve to supplement the statistical results. We will use similar procedures to those already tested in other study sections employing questionnaires, and on the basis of the return rates and quality of responses received, we feel that the questionnaire offers a valuable supplementary approach to the crime study section.

L. CITY AND NEIGHBORHOOD CHARACTER

In this section of the study we hypothesized a relationship between the physical structures in an area and neighborhood behavior and activities. For example, a residential neighborhood which supports ever increasing volumes of through traffic undergoes certain subtle changes as the neighborhood becomes a thoroughfare for more people than it is a stationary environment - the home - of others. We hypothesized that the change might be perceived in the behavior of those who live in the neighborhood. Can people use front yards or sidewalks for activities other than transit? Can visiting, children's play, or conversational get-togethers be observed out of doors? Is it safe for residents to keep pets? Physical structures might also affect the patterns or frequency of some activities. Do tall buildings create large areas of shade on sidewalks or in yards? Do views from the neighborhood and along the street encourage those indoors to sit by the window, or do people seem to seek complete privacy from the outside?

We chose two residential blocks in Pacific Heights to test our observation checklist in the field, and to determine the feasibility of, and personnel requirements for, making accurate observations and notations at the scene. One block featured dominant high-rise buildings; the other was a non-high-rise block. We learned that it was feasible for

our observation teams to complete their reports accurately and thoroughly. In Step 3, we will apply our methodology to a variety of paired sites in both commercial and residential areas.

Our observations included the numbers and kinds of people walking, conversing, in groups or singly, engaged in maintenance or recreation activities, on balconies, in windows or yards, coming and going. We also recorded the numbers and kinds of interactions between people. Physical details of the neighborhood were described and located, including greenery, fences, privacy signs and general neighborhood upkeep. Our full report will use photographs where useful to illustrate these details.

Our test results do indicate that we are focussing on significant parameters of neighborhood character, and that we are able to observe how building developments can influence neighborhood behavior.

M. RESIDENTIAL STABILITY

In the residential stability section of our study, we developed a method to test the hypothesis that the incursion of a residential high-rise building into a predominantly low-rise residential neighborhood leads to increased turnover of resident tenure in the neighborhood. (Neighborhood residents might be induced to move away from a new high-rise building in their area for several reasons: the building might look incongruous and unattractive, it might block views; or the building's presence might effect an increase in neighborhood rents and property values, or evoke feelings of impermanence by implying additional future redevelopment in the area. Secondary effects such as increased vehicle traffic (and noise) could present an irritant, as could the high-rise resident population, if they were characteristically different from the rest of the resident population).

To test the method, we devised the following procedures. First, we located a site of recent residential high-rise development in an otherwise low-rise and comparatively stable neighborhood in Pacific Heights. We determined a roster of residents who had lived on the block of the high-rise for at least five years prior to demolitions for and construction of the building, and checked this roster against a list of those residing in the neighborhood after the high-rise was complete and occupied. Third, we queried those residents from the original list who had moved during the demolition and construction period, or soon after the high-rise was occupied, whose present San Francisco addresses could be determined, to learn their principal reasons for moving. Given the present addresses of the relocated residents, during Step 3 we can compare the neighborhood, socio-economic, and basic housing characteristics of their present location with those of the test site for clues to the pull or push factors influencing their move.

We also devised a second questionnaire to ascertain the satisfaction with their neighborhood of residents who had abided on the block for a very long period, inclusive of the high-rise building's construction and settlement. All questionnaires were administered by mail, and we received a 69 percent return from those who had moved, and a 45 percent return from long-term residents abiding in the neighborhood. Both samples were small, to insure the sending and return of questionnaires within the comparatively short feasibility step.

The responses were full and specific. A number of factors were reported to have influenced residents' moves away from the site, and to have contributed to increasing or decreasing residents' satisfaction with the neighborhood. The high-rise building figured prominently among these factors, and we conclude from the test that we are focussing on an important high-rise impact issue. Once we have conducted our tested procedure for a variety of sites during Step 3, we will be in a position to evaluate the relative stabilities of the high-rise and non-high-rise neighborhood populations in those neighborhoods, and the extent of stability or instability which can be expected to result from changes in block type in the different development alternatives.

N. RESIDENTIAL PROPERTY VALUE

In addition to our separate analyses of the various social and environmental effects of high-rise buildings discussed elsewhere in our study, we attempted to determine the collective value which San Francisco residents place upon the changes in these factors which are induced by high-rise development in their community. Although we know of no valid methods which can determine separate values for these effects, we do have a method that has been thoroughly tested for estimating the value of the collective effects of an urban feature. The effects of high-rise buildings on the value of properties near them can be evaluated using a multiple regression analysis technique.

The method recognizes that individuals evaluate a number of factors in determining the price they are willing to pay in buying or renting their home. They begin with the size, quality and special physical features of the structure. Proximity to shopping and place of work are important, and to families with children, the quality and proximity of good schools is a consideration as well. There are many other factors of varying degrees of importance, and among these are the "quality-of-life" amenities or nuisances associated with the home's location, as well as a speculative value of the property for a use yielding a higher financial return.

The model used for the regression incorporates variables which account for the influence of physical characteristics of the dwelling and lot, such as floor space and number of units; characteristics of the community, such as population and housing density; and terms to account for other important influences, such as the construction of a new school or a

tall building.

To test the regression technique, we analyzed changes in the values of properties near a recently built residential high-rise building in Pacific Heights. We scrutinized values in the two census years which most closely bracketed the period of the high-rise's construction: 1960 and 1970. We obtained excellent data from the City Assessor's Office on sales prices and characteristics for twenty properties in the study area which were sold in both 1960 and 1970. Since this number was an insufficient sample fora proper regression analysis (at least forty were necessary), we supplemented these data with additional properties, using sales prices in or near 1960, and converted assessed values in 1970.

Our regression results were excellent: the values estimated by the regression agreed very well with the actual observed values, and the model actually "explains" almost 80 percent of the property value changes in our sample. Moreover, our results show that there is an extremely small extent of collinearity between the high-rise impact term and other variables, and therefore, that the coefficient of the high-rise impact term is measuring the impact of the high-rise exclusively.

In Step 3, we will develop a model to represent the effect on property values of the changes in block type offered by each of the development alternatives.

O. HIGH-RISE VISUAL IMPACT

In order to respond to comments and suggestions which arose during our Step 1-A presentations to the Technical and Citizens Advisory Committees to the study, we conceived an additional study section not proposed in our Step 1-A Report. We polled San Franciscans to learn of their preferences concerning the heights, kinds and numbers of tall buildings which might be generated under the different development alternatives. Our aim is twofold: the results of this inquiry will enable us to forecast the extent of content or discontent which is likely to result from the implementation of different alternatives; and the responses will provide meaningful input into the determination of the alternative development scenarios: that is, should the lowest level development alternative represent some stage of additional growth to present-day San Francisco, be San Francisco as it is today, or include "negative growth," stages or forms of development which have already been exceeded but which can be recovered or evolved.

The primary consideration of the questionnaire is to address how high-rise buildings look to people. However, we are also attempting to learn how individuals relate to tall buildings, through the set(s) of associations which the buildings connote to them.

We distributed a questionnaire by mail to residents in Bernal Heights and the Inner Richmond, and to workers in Nob Hill commercial businesses. In Step 1-B, we wanted to test how people would respond to the questionnaire, and whether it would allow them to express themselves fully and unambiguously. We also sought to determine what percentage of individuals would return their questionnaire to us so that we would know approximately how many questionnaires to distribute in Step 3 in order to obtain reasonably good confidence intervals for the different multiple choice questions of the questionnaire. Our choice of sample areas served two objectives: we sought to interview individuals who represented San Francisco residents and workers as a whole, and who we could be reasonably certain had occasion to look at San Francisco's high-rise buildings. Therefore, we sought to find representative areas which had a view.

All questionnaires were distributed by mail. In the commercial areas, we established prior contact with an employee who agreed to distribute the questionnaires according to our instructions, and collect them for return to us. Individual residents were also sent a postcard which they could return as an alternative to completing the questionnaire. The questionnaire was long, since we tried for the greatest comprehensiveness in the feasibility step, reasoning that we could improve our return rate in Step 3 by shortening the questionnaire. Fifty-two of 118 persons, or 44 percent, responded.

On the whole the responses proved somewhat negative towards the looks of high-rise buildings in San Francisco, and the concepts associated with them. However, we do not believe that the feasibility test sampled sufficient numbers for conclusive results. Our test has proven that the questionnaire is a feasible method, and has indicated to us the changes in format which will produce sufficient responses to derive valid conclusions about the response to the building development proposed in the different alternatives.